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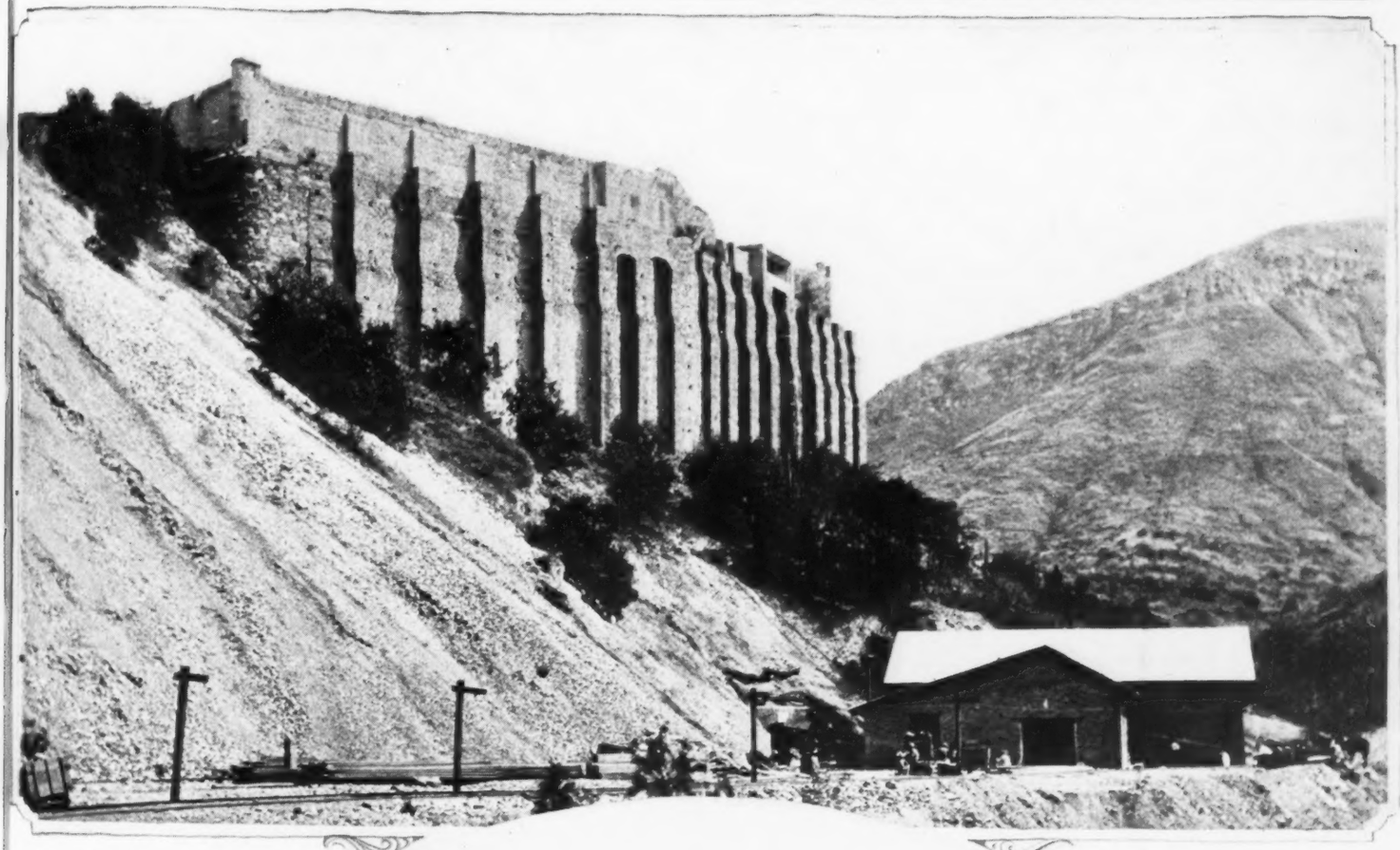
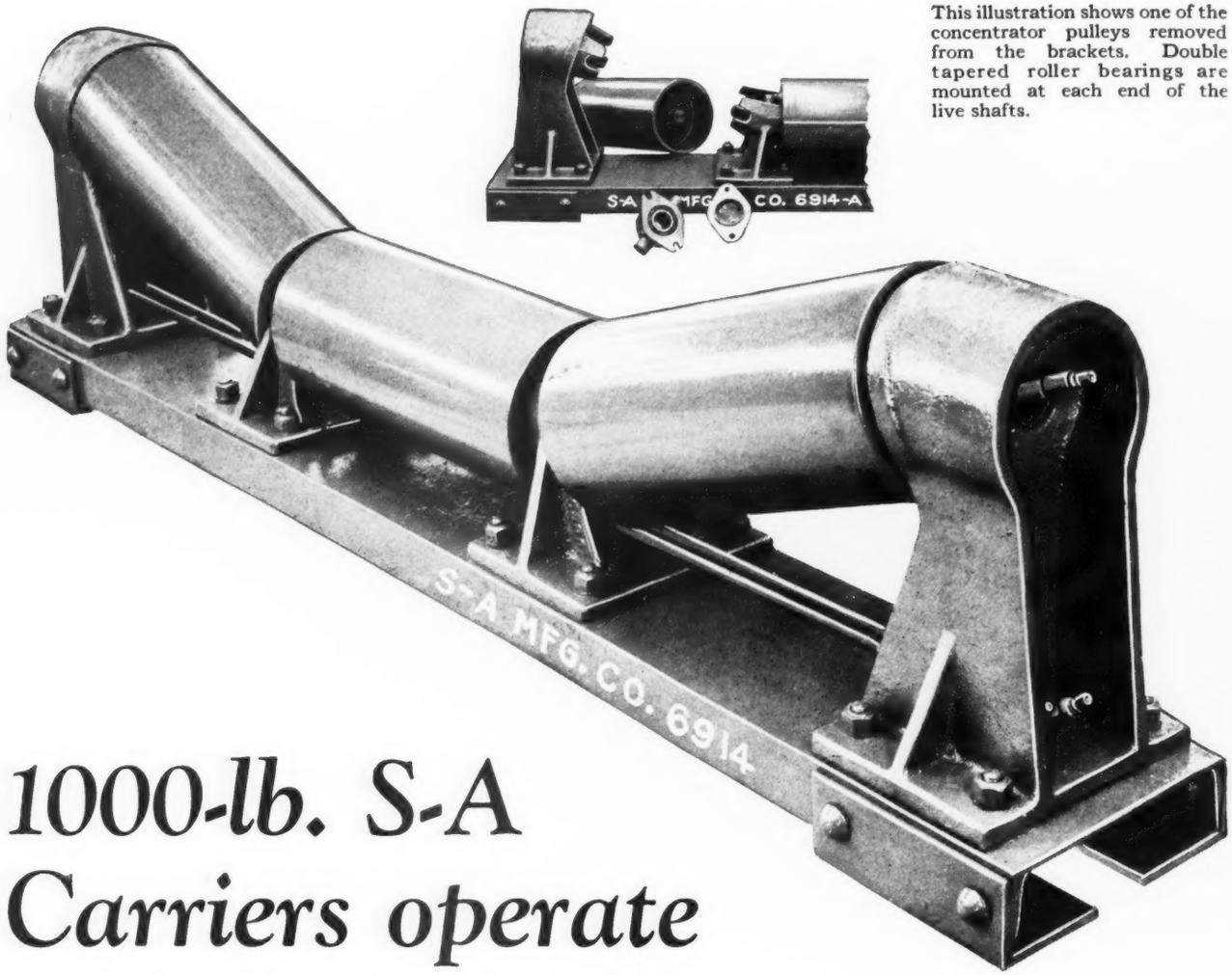


A Revised and Supplemented Theory of Electrical Prospecting
By Theodor Zuschlag

A.I.M.E. Holds New York Meeting

Rico Revived—What a Local Custom Mill Can Do for Mining
By A. H. Hubbell



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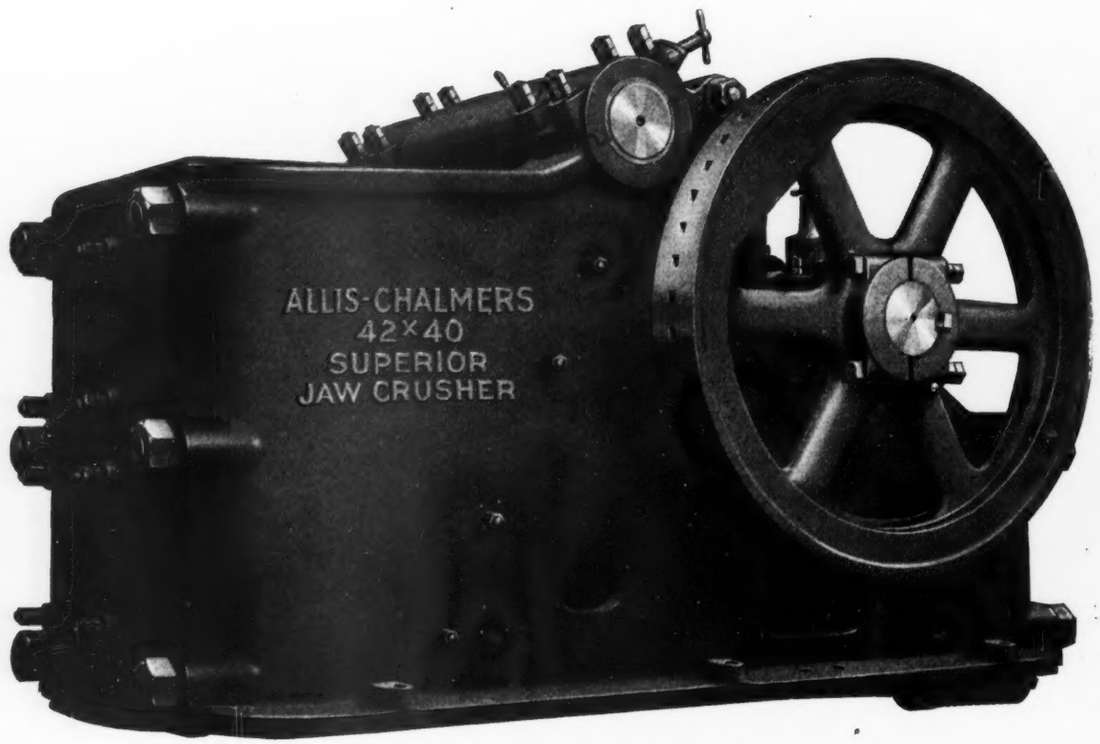

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 123 | New York, February 19, 1927 | *Number* 8

Canyon Platinum Claims

LATE IN JANUARY final adjudication was made for the Cameron United States Platinum Co. and other claims to so-called mineral ground in the Colorado River Grand Canyon region in the vicinity of the Bright Angel Trail. The claims in question were located in 1907, and adverse proceedings were initiated in August, 1922, on declarations that the land, claimed to be rich in platinum and other valuable minerals, in reality was non-mineral and that no discoveries of mineral had ever been made upon it. Repeated continuances were permitted, but although every effort was made to validate the claims the Secretary of the Interior sustained the adverse proceedings, saying: "The continued assertion of a baseless possessory right to these lands by the appellants and their co-defendants constitutes a continuing trespass and public nuisance. The public interest, therefore, demands that they be declared null and void."

The decision of the Secretary closes one of the most flagrant attempts to acquire valuable public lands under the guise of mineral claims. In the history of the West various attempts to acquire timber and other lands by filing under the mineral laws have been made, but, as in this case, where public attention has been focused sufficiently, the adverse proceedings have successfully prevented the lands in question from passing into private hands. Eternal vigilance seems to be necessary where public interest is involved.

That the electorate in general admire a man who has the effrontery to concoct such a plan as appropriating to himself valuable public lands by an unsubstantiated mineral claim is shown by the fact that one of the principal and persistent claimants, Cameron, is in the United States Senate.

The Secretary of the Interior, reviewing the proceedings in the case, states: "The uncontradicted testimony has been fairly and sufficiently summarized by the commissioner, and convincingly shows that these claims have been laid over lands and upon geological formations entirely barren of valuable mineral deposits, exhibiting no conditions favorable to mineral deposition. Evidence shows that, after careful and painstaking examinations by experienced mining engineers, the lands contain comparatively an insignificant quantity of placer material, in which was not detected, after careful sampling and assays by approved standard methods, any trace of platinum and no, or negligible quantities of, other metals for which the land was said to be valuable; that the hard character of the formation above the Granite Gorge, and the swift-flowing river, and the huge boulders and other adverse conditions within it, present insurmountable obstacles to successful placer operations on these claims, and that the expenditure in works of a mineral nature are meager and of no value."

Capital and Mexico

REGARDLESS OF THE RIGHTS AND WRONGS of the dispute between the United States and Mexico over the new petroleum laws—and it seems likely that the balance of evidence to date is in favor of Mexico in this controversy—the net result is to keep away from the country the further investment of capital, which is waiting to see what the outcome of the various disturbances created by the Calles administration will be. In most of these disturbances the sympathy of those most cognizant of the situation is apt to go to Mexico—with the marked exceptions of Mexico's needless meddling in the Nicaraguan mess, and her amity toward Bolshevism. In any case, however, not one but a number of hornets' nests have been stirred up, so that capital is awaiting the outcome. Further capital will not be invested in a country that may be upset by further wars, domestic or foreign; or in a country where the doctrine of capitalism and the rights of property are not recognized. That is evident on the face of it.

The Russians are struggling to harmonize this theory of anti-capitalism with a practice of capitalism, which they find necessary for their welfare and happiness, although they do not believe in it. In effect they say (as all intelligent men should know): "We hate capitalism and capitalists, which we believe to be responsible for all the ills of this world and the next: but we are broke or next to it. We need your capital and bid for it; as soon as things are going well, we hope we will be strong enough to take your capital away from you, confiscate your property, establish pure State capitalism if not communism, conquer your home country, and do away with private capitalism forever." And some bite; but most do not.

Mexican and other Latin American orators shriek that the Colossus of the North, the dollar-mad Yankees, are planning the conquest of their country. That, of course, has no real significance: we have our own shriekers in the Senate in Washington, our Heflins and our Reeds, et al.—and they impress and arouse the foreign countries far more than our statesmen and what they do and say. Altogether 'tis a mad world: but while the hullabaloo continues in Mexico, foreign capital, European as well as American, will hold off.

When Stocks Are Unloaded

ULTRA-SPECULATIVE MINING STOCKS are bought by two classes of people. One type of individual does not know any better, and swallows the bait offered by even the promoter, believing that the so-called mine really has good prospects of success. The other, and more experienced person, realizes that most of the selling talk is bunk, but feels that the stock is

likely to advance in the market and that by getting in early he can sell later at a good profit. Many have made money in this way; the only trouble is that no one knows just when heavy holders are going to unload. When they do, the price of the stock has a way of dropping so quickly that the daily reader of the quotations will be left with his profits only memories. For that reason, even those who are on to the game stand a good chance to lose.

As a recent instance of how a mining stock may exhibit all the characteristics of a kite out of control consider Kay Copper. This promotion has been well known to followers of Curb mining stocks for two or three years. Development has been carried on continuously at its Arizona property without startling results, though the price of the stock has been well maintained, varying between 1⅜ and 2⅞ in 1925, and between 1¼ and 2⅝ last year. It has recently been selling about $1.25; but on Feb. 8 some large holder or holders evidently decided to unload, or buying support was removed from the market, and in active selling the stock dropped from $1.25 to 25c., though there was nothing to indicate that the property was not worth just as much on Feb. 8 as on Feb. 7. The next day, in further gyrations, the stock advanced as high as 58c. a share. What chance has the ordinary small stockholder with a stock of this nature?

Portland Cement

ONE OF THE MOST IMPORTANT structural materials is portland cement. About 170,000,000 bbl. was produced in the United States in 1926. As the *Engineering News-Record* states, it is impossible to tell just where all of this cement went, or even to do more than to guess, more or less intelligently, as to the proportion of the various uses. Viewed from the mining angle, this 32,000,000 tons of cement means the quarrying of limestone and shale and the use of slag to the amount of close to 50,000,000 tons. Some 12,400 tons of explosive was required for the excavation of the material. In addition, fuel equivalent to the approximate amount of 14,000,000 tons of coal was required for furnacing the clinker. The industry thus derives the equivalent of 64,000,000 tons from mines and quarries. About $500,000,000 is invested in the business, which employs 60,000, with an estimated payroll of $100,000,000 per annum.

As most of the cement manufactured is used for concrete, the sand and crushed rock necessary for aggregates involves an additional amount of excavation and quarrying several times that required for the manufacture of the cement.

The industry, huge in a quantitative sense, is a part of the non-metallic mining industry. It ranks next to the petroleum industry in financial importance. Almost everyone's life touches the mining industry at several points; the office building in which we work and the home where we live have many reminders of the miner and his activities. One is apt to restrict his conception of mining to metals and coal, but although these are important enough, the industry includes many other materials, especially those used in building construction and in raw products for the chemical and metallurgical industries.

Cement is more and more becoming the almost universal structural material. Roads, pavements, dams, retaining walls, bridges, and buildings are dependent upon this material. The industry presents many real opportunities for the mining engineer and the technologist.

Stock-Selling Calisthenics

MR. SWOBODA, famous physical culture expert of New York, rehabilitator of men and women through the gentle art of calisthenics, and quondam promoter of Valenciana Deep, is cutting an ever-widening swath in mining circles in the West. Just what caused his incursion into the field of mine promotion he alone can tell. Did the competition with health exercises via radio get too keen? Or did the profit to be made look good? At any rate he is with us, and stepping wide and handsome.

Men like A. P. Swoboda, so some believe, inject new life in mining. For he is a salesman above all else, and finds it no trick, it seems, to take a block of stock of some company that is bored with ennui or suffering from financial complaint and sell it. One can picture what a clientele he will have in time—the nobles and the burghers of the mining world waiting in his anteroom, with the stock with which they once were stuck, but which now is no longer wall paper, if only this banner salesman will consent to sell it for them.

In the meantime he is making rapid strides. Valenciana long since disposed of, other operations have his kind attention. An option on large blocks of Chollar, Savage, and Gould & Curry companies on the Comstock is said to be his latest acquisition. From Alta, Utah, come stories of his "great merger," Mineral Veins Coalition, and he is likewise credited with the recent advance in the price of Sierra Nevada shares. There's the man who can do the trick.

Promotion work of this sort, of course, necessarily need have no relation to the making of a mine. It may, but usually all it does is make a temporary market for the stock. How much of the money goes into plant or underground is a matter entirely separate. And if some of it does go into operation, nevertheless it takes ore to make the mine. For instance, it is reported that Valenciana Deep is closed for good. The tunnel on which the operation's hope was centered has failed to discover ore. Those who sold their holdings through Mr. Swoboda's efforts have reason to congratulate themselves.

Variants of Riparian Law

THE RECENT LITIGATION on certain phases of riparian law, known as the Herminghaus case, has been carried through the California state courts and the supreme court of that state has definitely denied to a power company the right to conserve and use flood waters upon part of the watershed of the San Joaquin River. The decision is at variance with established principles of water conservation. Briefly, the court holds that "the riparian owners have a right to have the stream flow past their land in its usual course, and this right so far as it is of regular occurrence and benefit to the land is, as we have frequently said, a right of property, a parcel of the land itself."

The decision will no doubt greatly increase the cost of new power development and may in the end result in

abandonment of hydro-electric projects that involve lands subject to overflow. It will probably also have a bearing upon efforts now being made to resume hydraulic mining upon certain watersheds, for in such situations both water conservation and power development are necessary adjuncts to the scheme for rehabilitating hydraulic mining. Each watershed represents a specific problem, and until it is systematically studied in the light of this decision, its particular difficulties cannot be foretold. However, it increases greatly the power of the individual land owner to assess such projects and also increases the litigation necessary to establish the status of the claims involved.

Oil Shale in Esthonia

RATHER STRANGELY, it would seem, the Republic of Esthonia, concerning whose exact location and boundaries most of our readers are probably somewhat vague, appears to be the most striking practical exponent of shale oil. The last issue of the Foreign Trade Notes of the Bureau of Foreign and Domestic Commerce, in reviewing the Esthonian industry for 1925, reports that the state oil-shale mines made a profit in that year of 15,000,000 Esthonian marks, as compared with 10,000,000 in the preceding year. The big new distilleries (oil) started operating in the autumn, producing fuel oils, lubricating oils, gasoline, and asphalt. The Esthonian railways adopted shale oil as a fuel. Reports for 1926 are not yet available.

Confessedly, it is easier to make a profit in a state-controlled monopoly than in private enterprise. In Esthonia the mines and the retorting plants are both owned by the government, which may easily, by tariffs, prevent competition from coming too close.

In the United States, with competition between various sources of fuel and of power, the economic and marketing problem is quite another matter. To be sure, the profits of a state-controlled monopoly are in the end fictitious (if they are achieved through the powers of destroying competition possessed by the state), in so far as they appear to be profits accruing to the people of the state. The margin of profit, if it is so attained, is paid out of the pockets of the people in the form of taxes, or in the form of higher living expenses: so that they are in the end poorer and the country is poorer than if free competition should render the monopoly unprofitable. Against this is to be set, of course, the advantages of a home industry, which keeps money revolving at home instead of exporting it abroad, providing work as it does for the inhabitants; and also the independence of foreign sources of supply, advantageous in many ways. These, of course, are the old arguments in favor of tariffs, as well.

New Liability Under Workmen's Compensation Act

A RECENT DECISION of the California Supreme Court affecting liability under the Workmen's Compensation Law opens up a new and to some extent a disconcerting angle of this intricate law. The details of the case are briefly as follows: A workman who had previously suffered the loss of an eye through a non-industrial accident was employed upon the Hetch Hetchy project as a cement worker, the City of San Francisco being insured against liability by the California State Compensation Insurance Fund. The workman while chipping a concrete wall struck a blasting cap, the explosion of which resulted in the loss of the remaining eye. The Industrial Accident Commission, in view of the prior disability, granted to the workman a 26 per cent permanent disability rating, providing compensation in the sum of $2,187.15. A review by the Supreme Court annulled the commission's award and granted permanent total disability.

The legal decision thus rendered places the employer under the necessity of making a specific inquiry as to the physical status of every man seeking employment. Any workman who may suffer a partial disability, on the other hand, is almost wholly barred from industrial employment. The decision thus increases the cost of industrial employment and also narrows the employment field for the worker. Most carefully managed industries make inquiry as to the physical status of the workman seeking employment, but often employ one in nominal capacity even though he be known to have a prior disability. The decision of the court makes this practice unwise. It is understood that steps are now being taken to amend the California compensation law and to restrict the liability of industrial employers where prior disabilities exist.

State School Lands and Mineral Rights

A BILL conferring state and territorial title to mineral deposits in lands granted by the United States to aid public schools was approved by the Senate late in January, 1927, and has been signed by President Coolidge. The bill provides that all prior grants to the states by Congress for the benefit of public schools are extended to embrace mineral as well as non-mineral sections. The bill in question clears up a number of real difficulties and in this respect is commendable.

A Tinny Joke

"TIN CONTINUES TO CLIMB, but the well-known make of automobiles has not advanced in price; thanks to mass production methods," says the leading editorial paragraph in the last issue of one of our contemporaries. Thanks more, it might better be said, to the fact that probably less tin is used in the construction of the Ford than of most other automobiles. Trust the economical and efficient Henry Ford to substitute something else for high-priced tin so far as possible.

Varied and hoary are the jokes based on the idea of the popular flivver being made of tin, which, in turn, especially in its adjectivial form, is assumed to be the most despicable of all metals. It makes no difference if tin is really more expensive than iron, lead, zinc, copper, antimony, aluminum, and even the aristocratic nickel; it makes no difference if it has a silvery color, a bright luster, is not easily corroded, and is very malleable: it still ranks with the mother-in-law as an object of derision for the hard-pressed jokesmith. Is it not time that a Tin Publicity Association were formed to combat this evil influence? Can this be an insidious phase of the Hearst propaganda to discredit all things British?

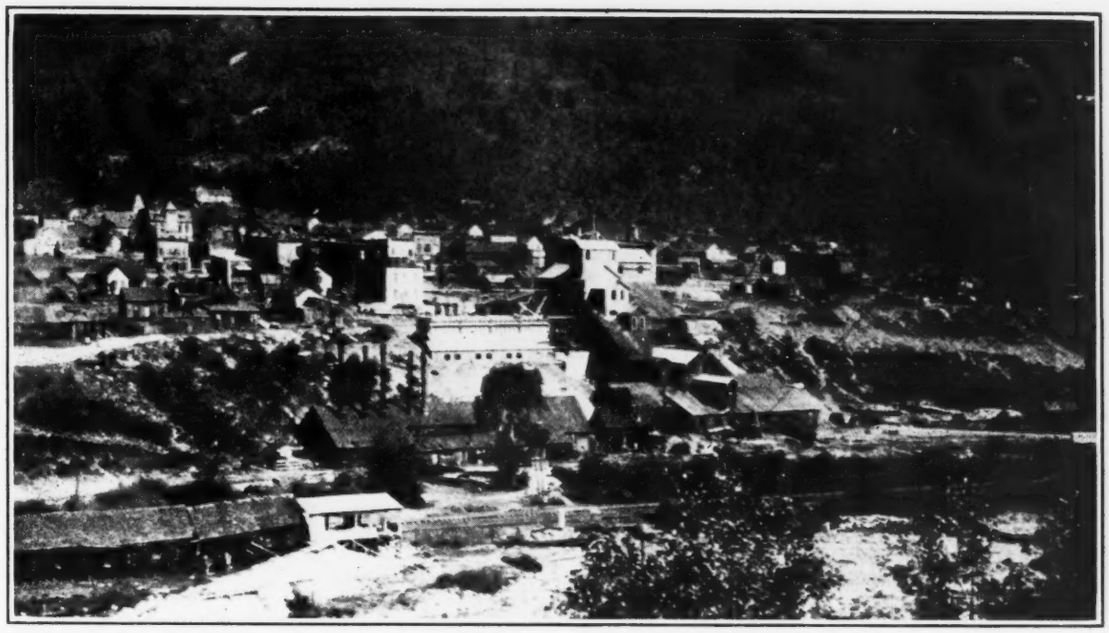
Rouyn—

Center of Quebec's Thriving Copper-Gold Area

Rico Revived

What a Local Custom Mill Can Do for Mining

By A. H. Hubbell



The town of Rico, Colo., and the International Smelting Co.'s mill, looking southeastward across the Dolores River from the Shamrock mine. In the background are the slopes of Newman Hill

OF THE OLDER MINING DISTRICTS in which zinc-lead ores are being sought at present, Rico, in southwestern Colorado, is among the most important. This camp is in Dolores Canyon, 35 miles south and west of Telluride, on the Rio Grande Southern Railroad. It has its past and is credited with a large production of silver and gold. Today it is the leaner ores, valuable chiefly for their lead and zinc, and which were formerly disregarded because they could not be handled profitably, that have brought the camp out from its obscurity, for a time at least. How sudden the change has been is witnessed by the following facts: A year ago the population of the camp was a few hundred; today it is 1,000 to 1,200. In July, 1925, money orders issued by the local postoffice totaled $2,000; a year later the total was seven times this amount. Of telephones the camp boasted twelve a year ago, since when the number has increased to eighty. All of which is evidence of a definite growth in Rico. A year ago its production was small. In 1926, it is estimated, about 35,000 tons of ores and concentrates was shipped.

To understand the revival of interest in the camp one must go back four years and to the State of Utah. At that time the International Smelting Co. began laboratory experiments at its Tooele plant on lead-zinc ores from certain Utah camps. After two years of this work it decided to go ahead and attempt to concentrate them on a commercial basis. It proceeded to remodel one unit of the Utah Consolidated mill at Tooele, which had come into its possession, for concentrating lead-zinc-iron ores. Later, desiring further tonnage, the company's search led it to various camps in Nevada and Colorado, its choice settling finally on Rico as the most promising for the future. This was in the summer of 1925. A contract was consummated with the company that had the largest reserve of desirable ores, namely the Falcon Lead Mining Co., for lead-zinc ore to be shipped from Rico to the concentrator at Tooele. Shipments were begun and continued until the beginning of last summer, when the Falcon was asked to stock the ore at Rico pending the construction of a mill there, on which the International company had decided. A desire to save transportation charges on the ore and to furnish an outlet for other possible ores in the district lay at the bottom of this decision.

Prior to the recent change in conditions in Rico, the principal companies there, either operating or inactive, were: The Falcon Lead Mining Co., now producing about 80 tons a day, which will probably be increased; the Syndicate Mining & Milling Co., whose holdings included practically all of the old properties on Newman Hill, from which a good part of the camp's early bonanza production had come; the Rico Argentine Mining Co., the Union Carbonate Mine, the Rico Wellington Mining Co., and a number of other smaller properties.

Last summer the International Smelting Co. took over those properties of the Syndicate company that had not already been taken over by the Falcon company, and has since incorporated them under the name of the Pelleyre Mining & Milling Co., which it controls. These properties are principally in the Newman Hill area, the old-time high-grade silver region of the 70's to the early 90's, which is honeycombed with workings, below which it is hoped to find large bodies of basic lead-zinc ores.

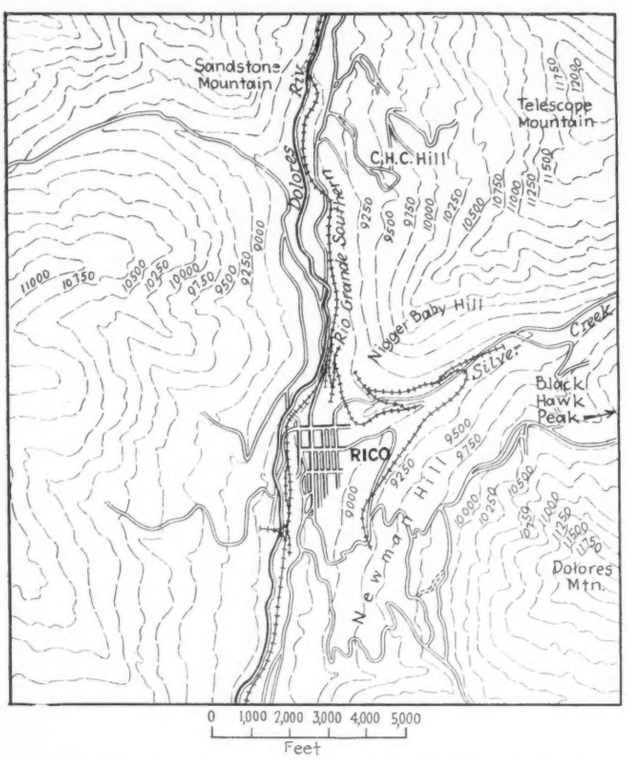
In addition to these, the company also has two properties close in town—the Shamrock and the Atlantic Cable, lying just across the Dolores River, which at Rico hugs the western wall of its canyon, flowing from north to south.

Another operator is the Rico Mining & Reduction Co., a subsidiary of the National Lead Co. This company has been opening up and prospecting for ore in several properties, including the Swan, Pigeon, Mountain Spring, the Argentine, and Rico Consolidated. A rumor has it that the U. S. Smelting, Refining & Mining Co. also has an option on some property in the district.

GEOLOGY—THE RICO FOLIO

The report of F. L. Ransome and Whitman Cross on the Rico district (Rico Folio, U. S. Geological Survey, 1905) is taken as the beginning of knowledge on the geology of the district. It is quite old, however, and contains little of interest on present-day problems. Most of these are said to depend on things that it does not mention.

The principal ore deposits occur in an area of about thirty-five square miles, the district being nearly co-extensive with the Rico Mountains—a dome-like uplift. At Rico these formations are elevated in a dome, the structure of which has been exposed by erosion. The center of this dome is close to the center of the camp itself. Through the center the Dolores River has cut its course, leaving to the east and to the west a crescent of peaks that are fairly uniform in height, all exceeding



Topography of the Rico district, Colorado, after the Rico Folio, U. S. Geological Survey

12,000 ft. and the highest 12,677 ft., or 4,000 ft. above the river at Rico.

As one stands in Rico, he is closely confined within the circle of these peaks and almost at its center, as the accompanying map will show. To the southeast and close at hand is Newman Hill, constituting the western flank of Dolores Mountain. Further to the east and highest of all is Black Hawk Peak. Following the circle around to the north the eye first crosses the gulch of Silver Creek to rest on Telescope Mountain, northeast of the camp and on the lower slopes of which are Nigger Baby Hill and C.H.C. Hill, the former immediately adjacent to the camp and the latter north of Nigger Baby along the river. Across the river and opposite C.H.C. Hill is Sandstone Mountain.

The geologic column, according to the folio referred to, is as follows:

		Feet
Cretaceous	Mancos shale	1,000
	Dakota sandstone	100-250
Jurassic	McElmo formation	400-1,000
	LaPlata sandstone	250-500
	Unconformity	
Triassic	Dolores formation	400
	Unconformity	
Carboniferous	Cutler formation	1,600
Carboniferous Pennsylvanian	Rico formation	300
Carboniferous Pennsylvanian	Hermosa formation	1,800-2,000
	Unconformity	
Devonian	Ouray limestone	100-300
	Unconformity	
Cambrian (?)	Ignacio quartzite	0-200
	Unconformity	
Algonkian	Uncompahgre	....

The first recorded prospecting in the district was done in 1861. In 1879 rich oxide silver ores were found on Nigger Baby Hill, and eight years later the rich blanket deposits on Newman Hill. The railroad came in 1890, and the camp's output increased until 1895, when it began to drop. Between 1879 and 1904 over 9,000,000 oz. of silver was produced and 73,000 oz. of gold. More than half of this came from workings in Newman Hill and most of the remainder from Nigger Baby and C.H.C. Hills. These ores displayed a wide variety in mode of occurrence. They are classified broadly by the writers of the folio as argentiferous galena ores and low-grade pyritic ores, the latter being the characteristic vein filling of most of the lodes and occurring in many of the other deposits. The galena ores formed the workable orebodies.

The ore horizon is near the middle and lower portions of the Hermosa. This formation consists of a series of limestones, shales, and sandstones, all more or less calcareous. One of these is a gray or blue limestone that is closely segregated in the middle third of the formation and of rare occurrence above or below, thus making it possible to divide the Hermosa (at Rico) into three approximately equal parts.

Two mines, the Shamrock and the Atlantic Cable, on the west side of the Dolores River, are in the Devonian. The Devonian outcrops on the east side of the river at the foot of Nigger Baby Hill.

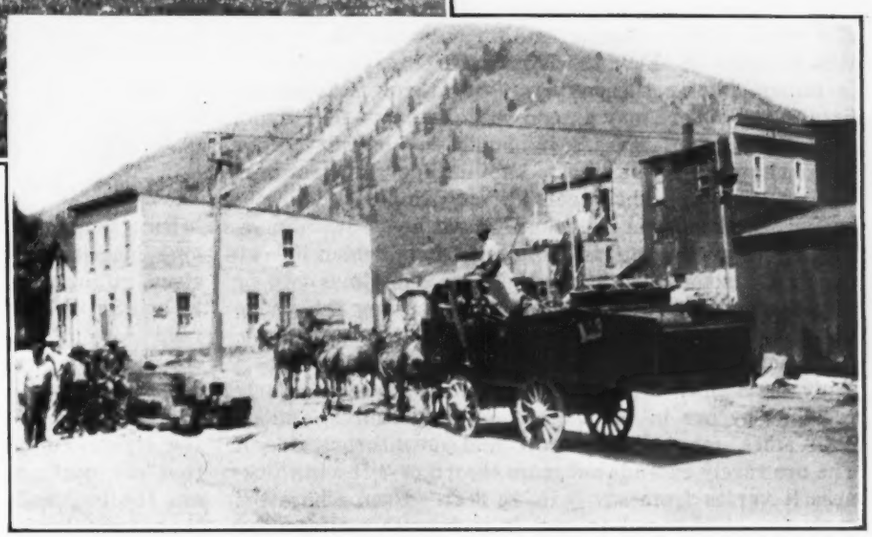
THE NEWMAN HILL CONTACT

The rich deposits of Newman Hill apparently bore a definite relationship to an impervious formation occurring nearly midway between the top and bottom of the series of sandstones, shales, and limestones of the lower part of the Hermosa formation. This was known as the Newman Hill or Enterprise "contact." The mineralizing fissures leading upward finally arrived at this formation, and the mineral-bearing solutions, unable to rise, spread out laterally. The resultant orebodies were rich, and from them came the early production of the camp. Ever after the discovery of this ore until the

last few years all work was done in the hope of finding the Newman Hill "contact" elsewhere with similar ore accompaniment. Recent experience, however, has caused many to become skeptical that this contact was more than a local condition in Newman Hill. At any rate, it has not thus far been found elsewhere.

Most of the recent prospecting in the Rico district has been done in the hope of finding zinc-lead deposits in the limestone beds of the Middle Hermosa. What success has been had in finding new ore is something that only the companies which have done the work can tell authoritatively.

The construction camp. Tents were necessary to accommodate the sudden increase in population



Hauling a classifier from the station. In the background, Nigger Baby Hill

Falcon the Principal Producer

The principal operator in the district is the Falcon company, which has been developing deposits on Nigger Baby Hill during the last three years, with some success. Several important replacement zones are being worked, one large lead-zinc orebody, replacing the limestone beds, having been followed for over 700 ft. along a series of fractures, with the ore continuous all the way. Considerable Falcon ore is now stocked at the International mill, where it is gradually being treated, together with the company's current output of more than 2,000 tons per month.

The second largest producer in the last year and a half has been the Rico Argentine Mining Co.'s Black Hawk mine, in Silver Creek Gulch. Here four replacement bodies in limestone (in the Middle Hermosa) have been developed in recent years and are yielding the present production. In 1926 more than 5,000 tons of lead-zinc-ore was shipped to Salt Lake Valley smelters, and since the new local custom mill was started, in November, the company has sent it approximately 2,000 tons.

These orebodies are related to mineralizing fissures, usually of quartz, cutting the beds of the Middle series, the most important of which is the Black Hawk fissure. The ore occurs in zones extending laterally from the fissure. Immediately next to the fissure comes iron pyrites, sometimes over 100 ft. wide and replacing the full thickness of the bed. Next to the pyrites laterally comes copper pyrite ore carrying silver. This copper ore is usually commercial. Next, laterally, comes lead ore; then zinc, the deposit finally tonguing out into the limestone. The ore usually does not replace the entire bed. The beds are separated by sandstones and shales.

During the latter part of 1925, the Rico Mining & Reduction Co., which had been organized in Denver earlier in the year to develop several properties, secured the backing of the National Lead Co. and increased the scale of its operations. After installing the necessary plant, it began work early in 1926. All of its prospecting is in the Middle Hermosa, except in the Swan mine, which is in the Lower series. None of it has reached the Devonian. Save in the Swan, it is also near the Black Hawk fissure. The company hopes to find lead-zinc deposits in the limestone beds of the Middle series, this being true of the work in the Pigeon, Mountain Spring, Argentine, and Rico Consolidated. In the Swan, in the Lower Hermosa, mineral-bearing fissures are being developed and some ore is being mined. In both series the ore is about the same, but there are differences otherwise. The Swan ore is in a fissure with no bedded deposits and runs about one-half of 1 per cent

to 1 per cent copper and 7 oz. silver, the lead-zinc varying with the iron, differing from the mines up the canyon, where the copper content varies, depending on the relation to the mineralizing fissures. In the Swan these fissures usually carry some ore. Up to the present the company has sent about 2,300 tons to the local mill, most of this since Nov. 1.

UNION-CARBONATE SHIPPING CARBONATE ORES

The fifth important operation is the Union-Carbonate Mine. This property contains thirteen closely spaced mineralizing fault fissures, approximately parallel, with several cross fissures. They cut four known replaceable beds, of which only the upper two are being worked; these lie above the level of two adits, the Lower Tunnel and the Carbonate Tunnel, the latter of which is 40 ft. higher than the former. The Carbonate Tunnel is driven on No. 1 fissure, the most northerly one in the property; the Lower Tunnel on No. 13, the most southerly fissure at present developed. The distance between the fissures is 520 ft.

The "upper blanket" is a thin bed of limestone, usually very highly altered, and often replaced by ore, which varies in thickness from, say, 6 in. to 3 ft., but is found only on the south or downthrow side of the fissures. This ore may extend out 20 ft., as a maximum, from the fissure. The upper blanket has usually a floor of porphyry, often altered to kaolin under the best ore; and a roof of soft shale, very difficult to hold. It is not known whether other "blankets" exist above it.

The "lower blanket" is calcareous shale, which is very irregular; sometimes a single layer, sometimes two or three layers separated by sandstone. Along the strike the shale often thins out, fingering out into sandstone. Elsewhere it is more calcareous, and grades into a shaly limestone. The lower blanket is also irregularly replaced by ore in the vicinity of the fissures, and on both sides (that is, upthrow and downthrow sides). The ore rarely extends out more than 6 or 7 ft.; in thickness it varies from say 3 in. to 3 ft. Even where the shale is not changed to ore, it is intensely altered by the acid solutions formed by oxidation of sulphide ores.

The ore is lead carbonate, and is usually soft. It is shipped to the American Smelting & Refining Co. at Durango. Owing to high treatment and freight charges, and to the fact that the tonnage is insufficient to justify building even a small mill, the low-grade material is left behind in the mine as filling, or placed on the dumps. The last thirty-six cars shipped (written Nov. 2, 1926) averaged as follows: Gold, 0.07 oz.; silver, 13.70 oz.; lead, 24.6 per cent; zinc, 2.18 per cent; sulphur, 2.71 per cent; iron, 20.1 per cent; insoluble, 20.8 per cent; and moisture, 15 per cent approximately.

ORE HARD TO DISTINGUISH FROM WASTE

All work is done by hand, and extreme care in mining is required to avoid mixing the ore with waste. Great skill is necessary to distinguish ore from waste, by slight differences in color and texture. A large number of working places must be kept open, and a relatively large amount of development work done, to maintain the present output of five tons daily (of dry ore). A single-span jig-back cable tramway 2,500 ft. long delivers the ore to a storage bin, which holds nearly 100 tons, on the main Silver Creek road, less than one-half mile from the railway. Construction of the tramway was hardly justified by the tonnage of ore available, but it was necessitated by the fact that it proved impossible to get ore shipped at all by road in winter.

No sulphide ore is mined at present, owing to the danger of mixing. The ore has to be handled several times and is so sticky that it is almost impossible to clean the chutes each time the character of ore changes. If the ore is allowed to "pack," it is said to be almost as difficult to dig loose as when in place.

Several of the drifts and other workings, however, show sulphide ore, and at some future time the mine will produce lead-zinc sulphide ore instead of carbonate ore. As far as possible, however, the change will be delayed, it is said, and made all at once, for the reasons above outlined. So far as can be seen at present, the lead-zinc ore is rather higher in grade than is usual in the district; that is, it contains less pyrite.

The mine is a very interesting one to study, according to the manager, George E. Collins, because it illustrates in miniature the conditions under which ore is likely to be found elsewhere in the district, and as each point can be proved at relatively small expense it may be used as a laboratory for the study of economic geology. A fairly accurate description is given by Ransome in the U. S. Geological Survey's Twenty-second Annual Report, 1900-1901, pp. 341-346. During 1926 the mine shipped eighty-two cars of lead carbonate ore to Durango.

THE TOWN ITSELF—THE NEW CUSTOM CONCENTRATOR

Rico today presents the aspect that any small camp long inactive, but which has suddenly had its hope revived, might be expected to offer. Practically everything to be seen lies within a few hundred yards of the railroad station. The small area of the camp is shut in on the east and west by the two crescents of the peaks already mentioned. In the space between the Dolores River on the west and the hills on the east it lies—a few streets running east and west crossing a few others that are north and south, along which, widely spaced, are the buildings, business and residential, that grace the town. Reminiscent of better days with an occasional structure of a more substantial sort, the town now looks forward to a respite from oblivion. In the center of the picture is the new 250-ton mill of the International Smelting Co. A considerable tonnage of ore is stocked near by awaiting concentration. This is mostly from the Falcon company. Other ore of lower grade will be received from other properties. The feed of the new mill should average about 12 per cent lead, 18 per cent zinc, and 12 to 15 per cent iron.

The new mill, which was started on Nov. 1, stands on the site of an old gravity concentrator, the Pro-Patria, built about forty years ago, which used jigs and tables and was of from fifty to seventy-five tons' capacity. This mill had been tried several times in the past on the basic ores of the camp, without success. During the war it worked for a short time on tailings and made a little money under the high metal prices then prevailing. Parts of the old structure are included in the present building, but otherwise the plant is entirely new, including its equipment.

CAPACITY 250 TONS

The mill is designed to treat about 250 tons daily by flotation, no gravity work being done. It is distinctly a custom mill, the International company's own mines in Rico being incorporated separately as the Pelleyre com-

pany, as has been previously stated. Prior to starting, the mill had contracts for handling the ore of the Falcon, the Rico Argentine, and the Pelleyre companies, and probably has secured others since. Besides those named there are about six other small operations. In the district there are also quite a number of now dormant properties.

All ore received at the mill is hauled there by teams and wagons in summer and by sleighs in winter. The receiving bins were designed to handle ore delivered in this way. The elevated approach to them and the similarly elevated roadway leading from them are inclosed, save overhead. Five 150-ton bins stand adjacent in a row. These are completely floored over on top, with 8½x3 ft. trap doors over each in the floor. A wagon is driven over the partly inclosed approach on to this floor, and after dumping passes on and leaves the floor at the far end through the partly inclosed passage there. A scheme for dumping wagons quickly is being worked out. The ore before dumping is weighed in a scale house, and thence is delivered to the five receiving bins. From these the ore is fed on to a 30-in. belt conveyor and thence to a 15x24 in. Blake-type crusher, set to 2½ in.; thence elevated to the top of the sampling mill, where the first sample cut is made, the sample going down the automatic sampling tower. The sampling equipment consists of Snyder samplers, crushers, and rolls. In this way a 200-lb. sample is obtained for a lot of any size, to be run for both moisture and analysis.

The reject from the sampling mill goes to a set of 16x42-in. heavy-duty rolls, and is crushed to approximately minus 1 in. There are no screens or trommels and the crushing is on open circuit. The crushed product is elevated to fine-ore bins, of approximately 350 tons' total present capacity, which is to be increased. From these it is fed to an 8 ft. x 36 in. conical ball mill working in closed circuit with a 6 ft. x 21 ft. 8 in. rake classifier, which will deliver an overflow of approximately 1½ per cent on 65 mesh and 80 per cent minus 200. The classifier overflow constitutes the flotation feed.

THE FLOTATION DEPARTMENT

The overflow goes to the lead machine—a 14-cell 18-in. special Minerals Separation sub-aëration machine of the latest type. This machine will be gear-driven, the primary drive being a 40-hp. motor. One-pound air pressure from a blower is used on this machine. Here a rough lead concentrate is made and a lead middling, which is returned to the head of the lead machine. The rough concentrate goes to two 6-ft. Fagergren cast-iron machines, in series, for double-cleaning. The cleaner tails go to the head of the lead machines.

Tailings from the lead flotation machine are pumped to the head of the zinc machine, which is exactly similar to the other machine. The zinc machine makes a clean concentrate in the first few cells, and a zinc middling, which is returned to the head of the same machine for re-treatment. The tailings from the zinc machine will be pumped approximately 2,500 ft. through a 4-in. wrought-steel pipe for impounding.

The lead and the zinc concentrates go to a 20-ft. and a 25-ft. tank thickener, respectively, from which they are pumped by a 3-in. duplicate pressure pump to a 6-ft. six-disk filter. This is partitioned through the tank and through the center shaft, giving three disks for lead and three for zinc. There is a valve on each end of the filter, so that there are really two independent filters in one. This is a very compact arrangement, which economizes on floor space. The filter is operated by an 18x6-in. dry vacuum pump. From the filter the dried concentrate will be conveyed to cars.

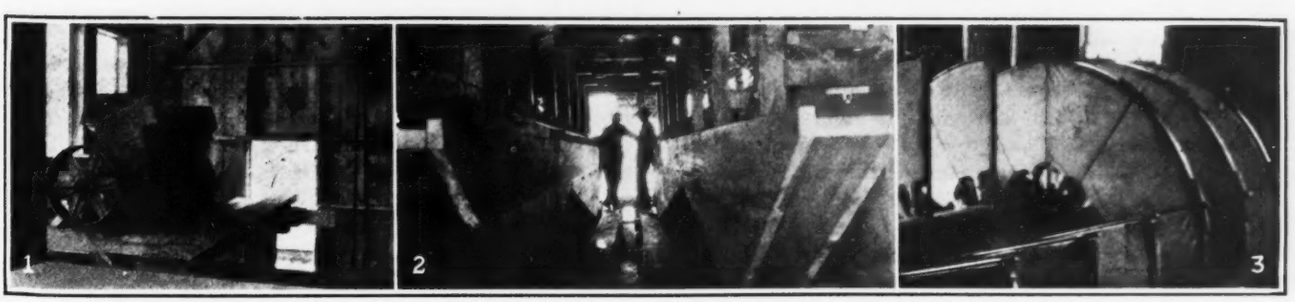
The reagents used and the process followed are much the same as used in the concentrator at Tooele. No iron concentrate is made, as the silver and gold values in the iron are not sufficient to pay for transportation. The iron is sent into the tails to waste. The quantity of gold and silver in the crude ore is small. So far the base lead-zinc ores developed have shown small values in this respect.

A diversion dam has been erected by the company across Silver Creek to provide a water supply. The water is brought down about 2,000 ft. through a 4-in. wrought-steel pipe to the tank at the head of the mill. For this operation, the Western Colorado Power Co. has had to build a 16-mile power line from its generating station at Ames. From there the power is transmitted at 11,000 volts to the mill, where it is stepped down to 440 volts. For use at the mines of the Pelleyre company it is stepped up again to 2,300 volts.

A force of approximately forty men is required to operate the plant.

From the time when the mill started, about Nov. 1, 1926, up to about Jan. 1 of 1927, it had shipped 110 cars of zinc concentrates, these going to Bartlesville, Okla., and 74 cars of lead concentrates, which went to the A.S.&R. plant at Durango.

The revivification of Rico is of interest to operators and mine owners in other Western camps, who have collectively a tonnage of low-grade ore developed that is sufficient for a small concentrator such as that described. It should be noticed that, in the present case, there was actual production at the outset that could be counted on and that a careful geological survey of the district indicated the existence of a sufficient tonnage of commercially desirable ore. It takes more than optimism to keep a mill in operation.



In the new International mill at Rico

1—The Fagergren flotation machine in place. 2—The M-S sub-aeration flotation machines. 3—The disk filter, partly set up.

Contracting as Applied at the Pilares Mine

Eighty-three Per Cent of Underground Work on Contract Basis—Yields Miner Higher Earnings and Gives Company Better Supervision

By E. Leland
Mine Superintendent, Moctezuma Copper Co.,
Nacozari, Sonora, Mexico

CONTRACTING at the Pilares mine of the Moctezuma Copper Co., Nacozari, Mexico, has been extended to practically every underground operation where it is at all applicable. It was started at this property several years ago, and through a natural process of development has been brought up to a point where at present 83 per cent of all underground men are working on contract.

The disadvantages of the straight wage system are so well known that no discussion of this is necesary. The subject may be summed up with the simple statement that under day's pay a definite amount of a man's time is purchased without qualifying the amount of work to be performed.

Bonus System

Where laws require the guarantee of a day's-pay rate to the contractors and their helpers, the bonus system has, no doubt, some advantages over contracting, from the workman's point of view, in that he is protected against losses, while on the other hand a limit is placed on his maximum earnings, a sort of middle course between day's pay and contracting. Where legislation has established this guarantee, it has been due for the most part to abuses on the part of the operator, who, either through ignorance or intent, adjusted contract prices not as working conditions changed but on the basis of net earnings of the contractor. In other words, the contract price was placed on the man and not on the work. Such a method is bound to cause discontent and no doubt has caused general distrust of the contract system on the part of the workmen in many localities.

Contract Permits Higher Earnings

The success or failure of any contract method of payment depends entirely on whether the operator has or has not a well-established fixed contract price for every phase of the operation and that these prices are only altered to conform to change of conditions, such as better or more efficient equipment, physical changes in the working place, or a general raising or lowering of the wage scale in the district.

Another point to be borne in mind is that the workman under the stimulus of contracting should make an average wage which is above the current day's pay for that class of work. If he fails to do this, the following points should be considered: Does the contractor thoroughly understand the class of work that he is doing? If not, he should receive the proper instructions, or be transferred to some other class of work with which he is familiar. Is the contract price at fault? If so, it should be adjusted at once. If the man is lazy and makes no effort, he should be dismissed.

It is imperative that the foreman in charge of the work investigate all cases of contractors' losses and correct the fault. On the other hand, under no circumstances should prices be reduced unless a change in conditions warrants. The very minute that the contractor feels that expenditure of extra effort on his part will result in a reduction of contract prices, the contract system starts on its road to failure.

Closer Supervision Maintained

Taking into consideration the existing labor laws, the temperament of the laboring classes, and the results obtained in the past by both day's pay and day's pay and bonus, the following advantages of the contract system are noted: The earnings are directly in proportion to the effort expended. There is a low supervision expense, as the contractor is the boss of the men in his employ and for the most part the company bosses act in an advisory capacity. A relatively high stoping efficiency is obtained due to the careful supervision on the part of the stope contractor. Also, as he hires his men, he chooses the best workmen and requires of them a full shift's work and, in case the workman proves unsatisfactory, he dispenses with his services without experiencing the unpleasantness that the company boss would in laying off a workman working on day's pay. There is an absolute control of all powder used, as a definite amount is allowed for each unit of work accomplished. The contractor is credited with any saving and debited in turn for any excess used. Under the contract system any increased efficiency increases the earnings in the same ratio and does very little toward the lowering of the direct operating costs. There is, however, a very decided indirect gain, in that fewer men are needed to accomplish the work. This results in lower expense for housing requirements, fewer men to handle in and out of the mine, fewer accidents, less equipment requirement and a more judicious use of supplies and material by the more skilled men.

Some Disadvantages

Some of the disadvantages of the system are: (1) A lack of flexibility with the working force, when the contractor or his men fail to report in a stope. The production either fails or is much lower for that day than it would be if it were easier to shift men from place to place, as is possible on a day's pay basis. This objection has been overcome to a great extent by holding the contractor responsible for a definite production from his stope, when he, in turn, is compelled to do all in his power to maintain a steady attendance on the part of his men. In general, however, with the contract system more working places must be maintained in order to guarantee the same production as would be necessary with the day's pay or bonus system. However, this in turn is probably more than offset by the increased efficiency, so that the objection may be more fancied than real. (2) An inability on the part of the company to lower labor costs without lowering the wage scale. This is at first thought an

argument against the installation of better equipment or machinery. However, by the installation of new machinery or equipment, conditions are changed, and this calls for new prices. The new price should be adjusted in proportion to the improvement in working conditions, so that the company and the workmen receive a benefit.

Contracts Let by Foremen

All contracts are let by the division foreman in charge of the work. In setting prices he is guided by a wage scale wherein are the prices for every mining operation to which contracting is applicable, with a sliding scale to take care of the range of conditions ordinarily met. All contractors are furnished with the necessary tools and material for the carrying on of their work, and every effort is made to eliminate any interruption in the work due to lack of compressed air, water, tramming, or hoisting service.

When a contract for any work is let, the price for each operation is verbally told to the contractor by the foreman. This is substantiated by a written memorandum of contract which is sent to the engineering department and a copy of this memorandum of contract given to the contractor. The memorandum states the working place, the price allowed for each operation, the unit of measurement, and the amount of powder allowed per unit. This forms a basis for all settlements with the contractor for work performed. In the case of development work, the wage scale carries a price for each class of ground. The class of ground is determined by a classification engineer, who determines the drilling and breaking qualities of the ground, the number of holes and the depth of round to be drilled, and the number of sticks of powder to be used in each round. The classification engineer makes his recommendations on each working place, prior to the starting of the work, to the foreman, who uses this as a basis for setting the contract price. The foreman has the right to use his own judgment in following this recommendation, but experience has demonstrated that the classification work in the hands of one experienced man results in a more uniform scale of prices throughout the mine than results when each foreman has to depend on his own judgment.

All other contract prices are set by the foreman, based on his judgment and in conformity with the wage scale and with the further approval of the general mine foreman. As a check and to balance prices throughout the mine in proportion to the conditions, all memorandums of contracts must be approved by the general foreman prior to their acceptance by the engineering department. Special contract not covered by the wage scale involving an expenditure of more than 25 pesos must be recommended by the general mine foreman and approved by the mine superintendent.

Work Measured by Engineers

All contracts are measured once each week by the engineering department and pay sheets are made up based on the contract prices as furnished by the mine department on its memorandum of contract, and the units of work performed as measured by the engineers. The pay sheets are forwarded to the accounting department, where deductions for powder and advances on account are made.

Whenever a contractor requires men to work with him, he hires them with the approval of the foreman and offers them what wages he cares to pay, usually somewhat above the company rate for that class of work.

For every day worked by the contractor and the contractor's helpers an advance is made to each individual's credit. This credit, which is entered daily on the payroll, is transferred to "carteras" or letters of credit, which may be used by the workmen for the purchase of foodstuff and necessities at the company store. Any balance due is paid in cash once a week. All advances made to the contractor and his men are charged to the account of the contractor, and before the passing of his net earnings to the payroll, he must submit a "split sheet" to the accounting department, setting forth the balance over and above the amount already advanced to each of his helpers, to which the helper is entitled to bring up his daily wage to the figure promised him by the contractor. This is a protective measure adopted to aid the men to obtain the promised wage from the contractor.

Contractor Held Responsible

On receiving a contract, the contractor is told that he is responsible for the safety of all men working for him as well as the safe condition of his working place. He must be constant in his attendance, do his work in a minerlike manner, and at all times comply with the orders and instructions of his boss. In all cases the contractor is told just what is expected of him, and a failure on his part to comply is just cause for suspension or termination of the contract.

A stope contract covers all phases of the work incident to that particular working place, such as breaking ore, mucking, waste sorting, timbering, waste filling, and spreading in the stope; also, in the absence of motor tram, waste tramming to the stope and ore tramming from the stope to the ore dump.

Allowances Vary

The powder allowance and breaking price have a wide range, to take care of varying conditions, such as hardness and breaking qualities of rock, width of the orebody, thickness of the cut, and class of machine used for drilling. The mucking price has a range which depends on the average distance from the broken ore to the chute. Spreading fill prices change with the distance from the waste chute, and vary, depending on the method of transportation in the stope—wheelbarrow, cement buggie, or car.

When faster drilling machines are introduced, or any method is changed whereby conditions are improved for the contractor, contract prices are adjusted to meet the new conditions.

Sorted waste is paid for at a fixed price per unit in addition to the mucking price. All silling in stopes is paid for at a higher rate than straight stoping. In cut-and-fill stopes the regular wage-scale prices cover breaking and mucking only. Placing bulkheads, safety platforms, raising chutes and manways, standing timber lines and other like operations are all paid for extra.

In square-set stopes, wage-scale prices cover breaking, mucking and the regular square-set timbering. Extra allowances are made for lagging, laying floor, raising chutes and manways, placing cribs and other extra work.

In the stopes the unit of measure is the one-ton car, cubic meter, or the square set. In car-count stopes

Basis of Settlement for Stoping Under Contract

Method	*Operation Performed*	*Units Used and Methods of Settlement*
Shrinkage	Breaking ore in stope (drilling and blasting)	Cubic meter as determined by engineer's measurements. Labor and powder allowed on price conforming with conditions.
	Drawing overbreak and final draw	Ton cars loaded or passed through grizzlies tallied at dump. Range in labor and powder price, depending on conditions.
Cut and fill (meter basis)	Breaking ore	Same as in shrinkage stopes.
	Mucking	Meters in chutes calculated by differences based on meterage extracted and broken ore in stope.
	Sorting waste	Meters of piled waste as determined by engineer's measurements at a fixed price above mucking price.
	Waste filling	Meters of fill trammed to stope. Meters of fill spread (meters trammed less self fill). Range is spread price depending on distance from waste chute in stope and method of transportation—wheelbarrow, cement buggie, or car. Track laying in stope and cement-buggie platforms on linear-foot basis.
	Timbering	Bulkheads and umbrella stulls. Price depends on height. Chutes, chute doors, chutes and manways, grizzly, safety platforms and safety bulkheads. Fixed price for each. Timber lines. Fixed price per set.
	Tramming	When contractors tram their ore to ore dumps. Payment based on meters of ore placed in stope chutes, as for mucking, with sliding scale for distance trammed.
Cut and fill (car basis)	Breaking ore	Powder and labor based on number of cars of ore tallied at ore dump. Range in price depending on hardness and breaking qualities of the ore.
	Mucking	Price based on number of cars of ore tallied at the ore dump. Range in price depends on distance of broken ore in stope from chute.
	Sorting waste	Same as under meter basis cut and fill, except that units are tons as computed by engineers' measurements.
	Waste fill	Same as under meter basis cut-and-fill stopes.
	Timbering	Same as under meter basis cut-and-fill stopes.
	Tramming	Price based on number of cars of ore as tallied at the ore dump. Range in price depends on sliding scale for distance trammed.
Square set	Breaking ore	Powder and labor based on number of sets extracted, as determined by engineers' measurements. Price range depends on hardness and breaking qualities of the ore.
	Mucking	Sets of ore shoveled into stope chutes or cars. Amount determined by engineers' measurements. Same method as used in meter basis cut-and-fill stopes.
	Timbering	Fixed price per set placed and blocked. Extras: Side lagging, top lagging and flooring at fixed price per panel. Chutes, manways, bulkheads and safety platforms, and all replacement and repair timber, at fixed price per unit.
	Filling	Same basis as under cut-and-fill stopes.
	Tramming	Sets of ore trammed to ore dump: Price range depends on distance trammed.
Top slicing	Breaking ore	Same as under meter basis cut-and-fill stopes.
	Mucking	Same as under meter basis cut-and-fill stopes.
	Timbering	Regular timbering range in price to suit conditions. Units based on meters of ore extracted. Floors and sills at fixed price per square foot. Extra timbering same as in other stopes.
	Tramming	Same as under cut-and-fill stopes meter basis.
	Exploration and Development	
Drifting	Breaking	Price per foot of advance for drilling and powder depends on classification of drilling and breaking qualities of the ground.
	Mucking and tramming (usually as a separate contract)	Total footage of advance per round at a certain price per foot, depending on mucking conditions and distance trammed. Round blasted to be completely mucked and trammed, either to waste dump or nearest point for motor.
	Timbering (usually given as a separate contract)	Fixed price per set placed.
Raising	Breaking	Price per foot of advance for drilling and powder. This depends on classification of drilling and breaking qualities of the ground, as well as height of raise above level. Price also covers placing stulls, platforms, and ladders.
	Mucking and tramming (to same contractor)	Price per foot of advance. Price for tramming adjusted on distance trammed.
	Timbering	In timbered raises, timber is paid for on a fixed price per set or foot placed.
Winsing or sinking	Breaking	Same as raising.
	Hand tramming	Price per car, meter or square set with range depending on the distance trammed.
	Motor tramming	Fixed price per car as determined by car tally to load, tram and dump in main ore dump all ore on the level. Similar contracts on waste tramming.
	Cutting ditches	Price per linear foot for drilling, powder, and mucking. Range in price for drilling and powder depending on hardness and breaking qualities of rock (depending on width and depth of ditch).
	Cutting corners on drifts and cutting-diamond drill stations	Meter basis for completed operation as determined by engineers' measurements.
	Widening and heightening drifts, enlarging raises, and similar work	Linear-foot basis for complete operation, as in cutting ditches.
	Track laying	Fixed price per linear foot of track laid, frogs, switches, and ties: Fixed price per unit. Salvage of fishplates, bolts, and track spikes: Fixed price per kilo. Track: Fixed price per foot. Track ties: Price per unit.
	Pipe installation, pipe salvage, pipe painting	Price per foot placed, painted or salvaged. Range in price depending on pipe diameter.
	Track cleaning, ditch cleaning	Range in price per linear foot, depending on conditions.
	Timber tramming	Price per piece of timber moved from shaft station to timber station or place of use, with range in price depending on the size of timber.
	Timber salvage	Same as above. Timber to be moved to either timber or shaft station.
	Guniting	Price per linear foot of drift or raise gunited. Additional price allowance for mixing and preparing gunite material, moving machine and other incidental labor.
	Drill sampling	Fixed price per 5-ft. hole drill and sample delivered to sample mill.
	Diamond drilling	Fixed price per foot. Company furnishes air and water only.
	Repair and general timbering	Prices have been worked out for practically all timbering operations, so that nearly all timbermen throughout the mine are on contract.

credit is given the contractor for each car tallied from his stope as it is dumped into the ore dump. These figures are compiled daily in the accounting department, and on settlement day placed on the pay sheets along with whatever extras in the way of timbering, sorted waste, or waste filling may have been done during that period. In car-count stopes no advance is made on the broken ore in the stope or in stope chutes, except when a contractor gives up his contract or is suspended. In this case, he is expected to clean his stope of broken ore, and his chutes are drawn empty in order to get a final settlement. In some cases engineers' measurements of the broken ore in the stope form the basis for the final settlement.

All shrinkage stopes are operated on the cubic-meter basis as determined by engineers' measurements. In the cut-and-fill it is optional with the contractor between cubic meter and car count, excepting in such a place that the expense of car tally is out of proportion with the tonnage to be tallied. The cubic-meter basis is to be desired, but many contractors are unable to understand this method of measurement and prefer the car count. Wherever the meter basis is used, the stopes are measured every week on specific days by the division engineer for that section of the mine. The meters broken for that period are computed from the plotted results of these measurements and the powder and breaking price for this passed to the man's credit on the pay sheet. Mucking is paid for on the basis of meters of ore put into the chute. This is determined by a measurement of the broken ore in the stope deducted from the meters broken.

In the square-set stopes the unit of measure is the square set, 5 x 5 x 7 ft. All overbreak beyond the timbers is measured and by calculation converted into sets to determine the volume of ore broken. Measurements of the broken ore in the stope deducted from the calculated volume extracted give the units of ore mucked

into the chute. The methods are similar to those used in the meter basis stopes, except that the unit is a square set.

Square-set timbering is paid for on the basis of the number of sets placed. All extra work in any stope is paid for, so that the contractor has no excuse for not carrying out the bosses' orders, when told to do necessary repairs, place extra timber, or any other extra work that may happen to come up in the natural course of events.

In all exploration and development work the unit of measure is the foot of advance. In drifting a separate contract for the breaking and powder is given and another contract is given for the mucking and tramming. In raising and winzing a contract is given to cover all the operation.

Quebec Asbestos Industry in Satisfactory Condition

THE Shelbrooke district in the Province of Quebec supplies more than 80 per cent of the total world production of unmanufactured asbestos, according to an article recently published in *Commerce Reports*. Most of the asbestos is imported by the United States. The 1925 production—273,522 tons, valued at $8,976,645—showed an increase of 31 per cent in tonnage and 37 per cent in value compared with 1924. An average price of $32.82 per ton in 1925 and $31.37 in 1924 was indicated, although the average for the fine grades of crude asbestos was lower in 1925 than in 1924. The increased valuation is attributable to a further standardization of grades needed for the specific industries, which enabled producers to obtain a better price for certain short-fiber grades extracted at the mills.

The extraction of ore for 1925 was very satisfactory. It amounted to 129.7 lb. of asbestos fiber per ton of rock mined, compared with 124 lb. per ton in 1924 and 117 in 1923. The increased extraction is said to have resulted from improved machinery and methods of handling the ore.

The production of various grades and their valuations in 1924 and 1925 are shown in the following table:

Asbestos Production of Quebec

Grade	1924 Quantity Short Tons	1924 Value	1925 Quantity Short Tons	1925 Value
Crude No 1	871	$318,761	1,044	$381,025
Crude No 2	3,550	721,165	3,777	778,895
Crude run-of-mine	222	34,730	348	49,030
Spinning fiber	9,799	1,085,918	16,070	1,710,379
Shingle fiber	21,569	973,356	30,010	1,523,980
Paper stocks	172,751	3,427,729	.....	.....
Millboard and paper fibers	.....	.....	93,935	2,915,046
Fillers, floats, and other short fibers	.....	.....	128,338	1,618,290
Total	208,762	$6,561,659	273,522	$8,976,645
Byproducts	16,464	9,934	16,865	10,814
Totals	225,226	$6,571,593	290,387	8,987,459

The Quebec production formed approximately 84 per cent of the world total in 1925, and about 82 per cent in 1924. The next largest output, 34,349 tons, came from Rhodesia. Russia was third. Both these countries and some others greatly increased their production in 1925, but the Canadian output advanced simultaneously to an amount which gave it the same relative proportion as in previous years. The value of Quebec asbestos, however, is not more than 65 per cent of the total, since the proximity of its mines to the United States market allows the profitable production of a number of classes of low-grade mill fibers. In 1925 the United States took 80 per cent of the total tonnage of asbestos exports from Quebec, which amounted to 66 per cent of the total value, owing to the fact that nearly all cheap short fibers are shipped to this country on account of cheap transportation rates.

Total shipments in 1925 amounted to 258,017 tons, valued at $9,682,392, compared with 204,749 tons, valued at $7,734,859, in 1924. Exports to the United States amounted to 209,879 tons, valued at $6,469,644, in 1925, and 161,815 tons, valued at $5,027,392, in 1924. The next largest shipments in 1925 were 11,000 tons to Germany, 8,700 to Great Britain, and 6,000 to Belgium.

The most important development during 1925 was the merger of eleven Canadian-owned asbestos-mining enterprises under the title of the Asbestos Corporation, Ltd., which will have an output well over a third of the total Canadian production. The prosperity of the Canadian asbestos industry has never been stable, because the abundance of orebodies available and the lack of co-operation have brought about overproduction when prices were good, except during and immediately following the war, when the demand was abnormally large. With the establishment of the corporation it is hoped to produce a situation that will limit production to the reasonable demands of the market.

The greater volume of production in 1925, and the reduction of costs by means of improved methods of milling and grading, made it a satisfactory year for the industry. The quantity formed a new record, and its value has been exceeded only in 1919 and 1920, when prices were unusually high owing to post-war economic conditions. Heavy purchases in the United States continued through the early months of 1926, and declared exports to this country from the Sherbrooke district were greater during the first half of the current year than for the corresponding period of 1925—increasing over this period from 87,676 tons, valued at $2,857,270, to 104,248 tons, valued at $3,457,841. The demand in Europe is good, although shipments to the United States slackened somewhat in the middle of the year.

Zirconium Is Replacing Tin in Ceramics

Compounds of tin have long been used in rendering ceramic glazes on pottery white and opaque, but recently zirconium oxide obtained as a byproduct in a preparation of titanium oxide and ferrotitanium has come to the fore as a material possessing a much greater opacity and at the same time being suitable for this use, according to the February, 1927, issue of the *Scientific American*. Some of the large pottery manufacturers have found that the new material effects considerable economies in operation while producing a ware of equal or superior quality. Zirconium oxide has also been used to some extent as a refractory for work requiring very high temperatures.

It is interesting to note that the larger production of titanium oxide for use as a pigment to replace white lead in the new nitrocellulose lacquers has contributed to the production of zirconium oxide in quantity and at a price to make it favorably competitive with tin. Thus at a single stroke is accomplished the conservation of two important common metals, lead and tin, and two others, ordinarily considered rare, are put usefully to work in industry.

Gold at Bannack, Montana*

By P. J. Shenon
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BANNACK, MONT., is on Grasshopper Creek in the central part of Beaverhead County[1]. The first important discovery of metallic wealth in Montana was the discovery of placer gold at Bannack in August, 1862, and the first quartz mine was located a short time later.

Limestones of Madison (Mississippian) age are in the region intruded by a fine-grained diorite. Three exposures of the diorite outcrop near Bannack, but in all they aggregate less than one square mile. The limestones have been folded into an overturned anticlinal dome and have been thrust over Triassic (?) "red beds"

Fig. 1—Native gold (white) in tetradymite (gray), showing tendency of the gold to follow parting planes. Tetradymite etched with nitric acid. Note structures developed by etching. Magnification 20 times

on the east. The diorite occupies the central core of this dome-like fold.

Ore deposits at Bannack occur at or near the contact between the limestones and the diorite and are typical contact metamorphic deposits[2]. The limestones have been marmarized into a coarse crystalline marble for some distance from the contact, and heavy garnet zones occur near the contact. The orebodies lie predominantly on the limestone side of the garnet zones, and some of the best deposits are found along or at the apex of diorite apophyses which extend out into the limestone.

Gold occurs associated with tellurides; along fractures in pyrite and chalcopyrite; as free gold in the porous oxidized ore, and in the placer deposits. Most of the gold from the Excelsior and Gold Bug (Dakota Lode) mines is found associated with tetradymite in a calcite, quartz, and garnet gangue. It occurs as irregular patches or shows a tendency to be oriented along parting planes in the tetradymite (see Fig. 1). The tetradymite is grayish-black, very soft, and resembles graphite. Free gold can usually be observed.

The ore mined from the Golden Leaf property, on the west side of the main diorite mass, is almost entirely

*Acknowledgments are due Dr. W. H. Emmons, Dr. F. F. Grout, and Dr. G. M. Schwartz for help and criticism.

[1]Winchell, A. N.: U. S. Geol. Survey Bull., No. 574, 1914, pp. 72. Weed, W. H.: *Trans.* A.I.M.E., Vol. 33, 1903, pp. 732.

[2]Emmons, W. H.: "Principles of Economic Geology," pp. 29-84. McGraw-Hill Book Co., New York, N. Y. Lingren, Waldemar: "Mineral Deposits," pp. 704-760. McGraw-Hill Book Co., New York, N. Y.

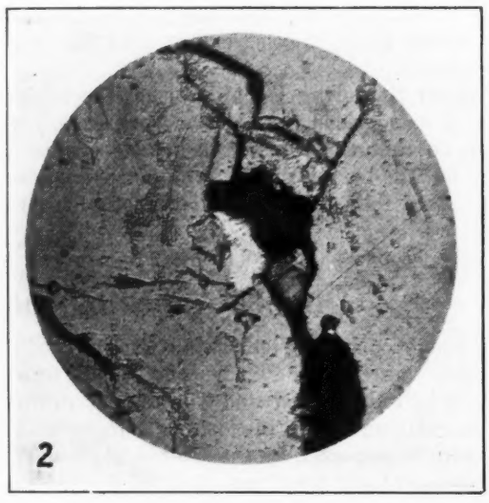


Fig. 2—Native gold (white) along fracture in chalcopyrite (light gray). Surface etched with concentrated nitric acid. The calcite associated with the gold along fracture (black) was removed by the acid. Magnification 150 times

oxidized. It is a soft, brown, porous material and can be broken down with a pick. Oxidation has liberated the gold, so that much of it is free milling. Primary sulphide ore is found on the Dunn level. Here the gold is associated with calcite and occurs along fractures in pyrite and chalcopyrite (see Fig. 2). Pyrite, chalcopyrite, and specularite occur in a gangue of calcite, green chlorite, quartz, and some garnets. These minerals appear to have formed contemporaneously, whereas the gold occurs along later fractures. Specularite is considered a high-temperature mineral[3]. Grubenmann[4] believes that chlorite forms under conditions of moderate temperature and low hydrostatic pressure, and he considers garnets as forming under enormous hydrostatic pressure and high temperature. The specimens studied from the Bannack district indicate that all three minerals have formed under the same conditions. The placer gold has undoubtedly been derived from the lode gold deposits, as placers are not found above Bannack.

[3]Butler, B. S.: *Economic Geology*, Vol. 10, 1923, pp. 400.

[4]Leith, C. K. and Mead, W. J.: "Metamorphic Geology," pp. 188-189, 1915. Henry Holt Co., New York, N. Y.

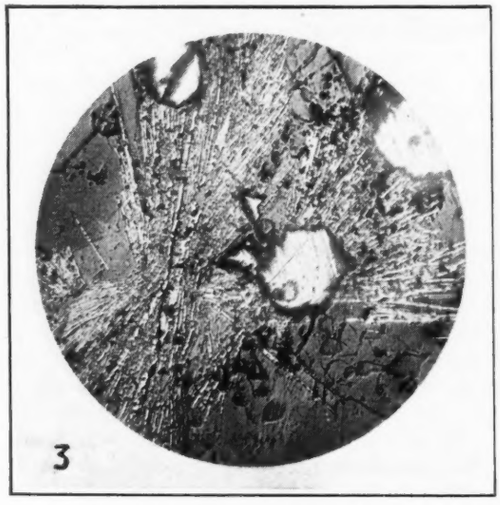


Fig. 3—Specularite (with radiating structure) in quartz (dark gray) terminating against pyrite (white). Magnification 20 times

The Problem of Electric Prospecting

Accepted Methods Incomplete—The Solution

By Theodor Zuschlag
Electrical Engineer, The Taumac Corporation, New York

RECENT DEVELOPMENT in mining activities in eastern Canada has reawakened the interest in electric prospecting. This is the art of exploring electric or magnetic groundfields and translating the accumulated data of such explorations into geological predictions. Before going into the details of the principle of electric prospecting, it is well to mention that the following is written not from the viewpoint of the mining engineer but from that of an electric engineer. This statement is necessary, because the methods of electric prospecting, as advanced and accepted during recent years, are herein proven incomplete and partly based upon misconceptions.

Scientific prospecting by geophysical exploration has been developed rapidly during the last few years. It is based upon the fact that geological changes in the structure of the ground are usually accompanied by variations of physical constants and that these variations can be located by suitable physical measuring devices and methods.

Electric and magnetic surveying methods utilize electric and magnetic effects and can, therefore, be employed to locate geological changes which are identical with variations of electric or magnetic constants in the ground, as for example orebodies, mineralized areas, ground waters, faults, salt domes, and like structures and formations. To explain the possible application and the practical working of these methods, it is necessary to give a short outline of the underlying principles.

The theory of electricity is the theory of electric and magnetic fields. The expression "field" indicates the existence of an electric or a magnetic pressure, resulting in an electric or a magnetic flow. An electric or a magnetic field may flow in one direction only, in which case it is called a direct field, or it may change its direction continuously, being then an alternating field, with either commercial frequency (15 to 60 cycles per second), or audiofrequency (60 to 4,000 cycles per second), or radiofrequency (4,000 to many million cycles).

An electric current flow is the source and the center of a rotating magnetic field. The direction of rotation is determined by and changes with the direction of the current flow.

An alternating magnetic field induces an alternating electric field of equal frequency in any material which it permeates.

The strength of any electric or magnetic flow in a certain direction is determined by the active electric or magnetic pressure in this direction and the active electric or magnetic resistance (Ohm's Law).

The reciprocal value of electric resistance is called conductivity or magnetic resistance permeability. Any physical substance can be classified as an electric conductor, an electric half-conductor, an electric non-conductor or insulator, and a magnetic or non-magnetic material.

The resistance of the conductor group is very low and dependent upon the geometrical dimensions, the temperature, and the frequency of the electric flow. This group includes all pure metals. The resistance of the half-conductor group is much higher and dependent upon the geometrical dimensions, the temperature, the frequency, the electric pressure, the direction and duration of the electric flow. To this group belong practically all minerals, rocks, ground waters. The conductivity of the non-conductor or insulator group is practically zero. To this group belong rock salt, quartz, mica, and similar minerals.

The permeability of magnetic materials, such as iron, cobalt, nickel, and their alloys, is high; the permeability of all other non-magnetic materials has about the same low value. Permeability depends upon the geometrical dimensions, the temperature, the frequency, the magnetic pressure, the direction, and the duration of the magnetic flow.

Considerable differences in regard to conductivity and permeability exist between many rocks and ores. This fact is fundamental for all electric or magnetic geophysical exploration. Most handbooks and papers dealing with this subject contain the resistance values for direct current only, although these values, especially in the half-conductor group, change often remarkably with the frequency of the flow.

What the Exploration Work Consists Of

Any change in the structure or strength of an electric or a magnetic flow causes a corresponding change in the structure or strength of the co-ordinated electric or magnetic flow. In electric or magnetic groundfields such changes are caused by variations of conductivity or permeability. Therefore electric or magnetic geophysical exploration consists in investigating the structure and the strength of electric or magnetic groundfields and in interpreting the results of this investigation as to the location and cause of permeability variations.

This object is attained by exploring:

1. The natural magnetic earthfield.
2. The natural electric earthfield.
3. Artificial electric and magnetic groundfields.

The exploration of the natural magnetic earthfield is carried out with the dip needle and the more sensitive magnetometer. It is limited to locating variations of permeability, such as are caused by iron deposits and in a lesser degree by salt domes.

A Compensating Magnetometer

I have developed a slightly different type of magnetometer, its feature being the electric compensation of such unavoidable instrument variations as are caused by temperature changes and accidental shocks. This compensating device makes this magnetometer especially adapted for locating extremely weak magnetic field variations.

Exploration of the natural electric earthfield can be

accomplished with electrodes or exploring rods connected to a galvanometer and is limited to locating spontaneous current sources, such as some sulphide ore deposits. Exploration of artificial electric and magnetic groundfields is carried out by means of exploring rods and induction coils connected to indicating devices. The investigation of artificial direct fields is employed very rarely and is, therefore, not considered.

Complicated Conditions in Alternating Fields Ignored

Until recently most of the apparatus and methods used for the exploration of alternating fields were based upon the simple laws of direct fields and were not adapted to the much more complicated conditions in alternating fields. To verify this statement it is only necessary to compare the general structure of direct and alternating fields.

The structure of a direct electric groundfield is given by the potential of a certain point in relation to the points of origin. That of an alternating electric groundfield of a certain frequency is determined by the potential and the phase of the potential with reference to the origin. The term phase means the amount of advanced or retarded alternation compared with a standard alternation. This difference in the timing of alternations is also called the phase angle and is measured in degrees. It is caused by the complementary reaction of electric and magnetic fields upon each other.

The structure of magnetic fields is given by the magnetic potential of a certain point, but as it is easier to understand a description in terms of intensity and direction, the following definition is preferable. The structure of a direct magnetic field is determined by the strength of the intensities in three directions perpendicular to each other at a certain point. That of an alternating magnetic field is determined by the strength of the intensities and the phase angles of the intensities in three directions perpendicular to each other at a certain point.

Phase Angle Must Be Considered

Alternating equal potential requires, therefore, identity of potential as well as of phase angle. As explained hereafter, this condition is normally not realized in alternating electric groundfields. For this reason, the direct plotting of lines of equal potential in such groundfields is impossible, because these lines do not exist. This is borne out by the fact that it is practically never possible to find in an alternating electric groundfield two locations between which absolutely no current flow is indicated. The lines determined and accepted under the pseudonym "equal potential" represent only instances of all kinds of possible minimum conditions in alternating electric groundfields.

Alternating magnetic field direction represents a similar case. If an induction coil, located in an alternating magnetic field, is turned, the strength of the induced currents varies. The plane of the coil in which the value of the induced currents is a minimum is considered parallel to the direction of the field. According to the explanations above, the intensities, as well as their phase angles, differ in alternating magnetic fields in three directions perpendicular to each other. A short and simple mathematical investigation reveals that in such a case no real direction exists, because the result of the computation is of complex value. This is verified by the fact that it is practically never possible to find a position of the coil in which absolutely no currents are induced. The planes of the coil in which a minimum induction occurs represent, therefore, only instances of all kinds of possible minimum conditions in alternating magnetic groundfields.

Application Limited to Simplest Cases

It is then, of course, not possible to declare that the lines of electric current and the lines of magnetic force are perpendicular to these minimum lines of minimum directions. They may cut them under different angles. This is especially true if the normal structure of alternating fields is disturbed by subterranean variations of electric or magnetic constants. On the other hand, this statement does not mean that these methods could not be used for geophysical purposes, but it shows that their possible application must be restricted to the simplest cases.

Alternating electric and magnetic groundfields used for geophysical exploration are normally of audio or lower radiofrequency. They are produced by grounding an alternating current source at two or more points or lines, or by connecting to the source a large wire loop of several hundred or thousand feet diameter.

The Two Arrangements

In the first arrangement the current is forced from one ground or electrode through the soil to the other electrode. The ground current, after leaving the first electrode, spreads, like a giant fan, in every direction and converges again toward the second electrode. This current distribution, called the primary electric groundfield, generates a primary magnetic groundfield of the same frequency. The magnetic field of the current, flowing in the wires connecting the generator with the groundplates, called the magnetic wirefield, induces stray currents or a secondary electric groundfield in the soil, which, in turn, generates a secondary magnetic groundfield of the same frequency.

The secondary groundfield differs in phase from the primary electric groundfield. Both fields form the main components of the resulting electric groundfield. The magnetic wirefield and the primary magnetic groundfield differ in phase from the secondary magnetic groundfield. These three fields form the main components of the resulting magnetic groundfield.

The same conditions prevail in the second arrangement for producing alternating fields, with the exception that the primary electric and magnetic groundfields do not exist. The distribution of the potential or the intensity of the above-mentioned components of the resulting groundfields is governed by different laws. This explains the fact, cited before, that potential and phase, or intensity and phase, vary at different locations as well as in different directions at one location.

The components of the resulting fields are complementary to each other—that is, any disturbance of any component disturbs the other components as well as the resulting fields, with the distinction that the magnetic wirefield and the primary and secondary electric groundfields are affected chiefly locally, whereas the primary and secondary magnetic groundfields are affected generally. The expression local affection means that the main distortion is restricted to the area of disturbance,

while a general affection, although decreasing inversely with the distance from the disturbance zone, is theoretically noticeable anywhere.

The classification in regard to local and general affections explains why explorations of alternating electric groundfields cannot be expected to prove successful in areas with considerable overburden.

Distortions of Alternating Field

Alternating field distortions are caused by surface conditions and variations of electric or magnetic ground constants. Distortions of the first kind are caused chiefly by the carrying out of observations in different elevations in relation to the current source. They can in many cases be eliminated by computation. Distortions of the second kind are determined by the character, strength, location, and geometrical dimensions of subterranean disturbances.

The character of a disturbance, electric or magnetic, determines the character of field distortions as to positive or negative potential, intensity, and phase angle variation, varying with the frequency of the field. The other disturbance factors determine the strength of the field variations.

Provided that, for a plurality of points, potential and phase variations, or intensity and phase variations in three directions, perpendicular to each other, are known, it is possible to interpret the general character and the approximate outline and, further, in the second case to compute the approximate strength and location of the cause of field distortions. If only parts of these data are known—for instance only the intensities in three directions—it is impossible to carry out the last-mentioned computation, whereas the interpretation of minimum lines and minimum directions can only be regarded as an interesting puzzle.

Unusual Accuracy Attained

The question is, how to determine the correct values of potential, intensity, and phase angle.

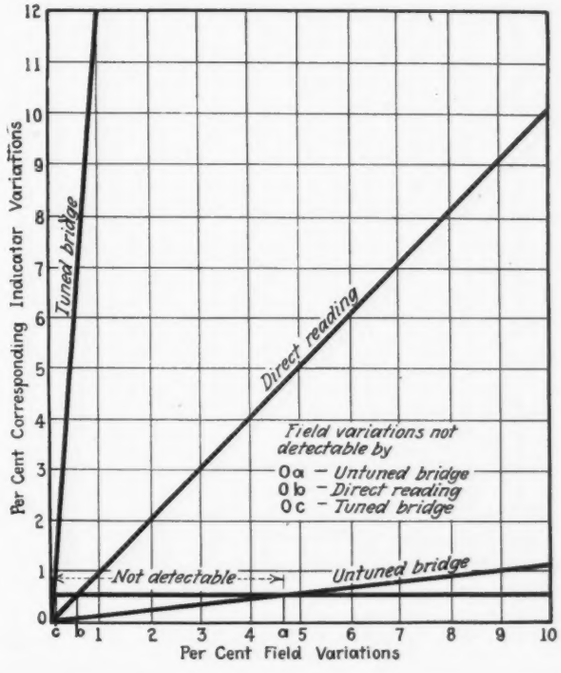
The methods that I have developed for this purpose employ for the investigation of electric groundfields one exploring rod, and for the investigation of magnetic groundfields one or two exploring coils. Rod and coils are connected with special balance arrangements, known in electric engineering as bridges. By balancing these bridges, it is possible to compute the potential or the intensity, as well as the phase angles, from the known constants of the circuits. By the use of special circuits the original deflections of the bridge indicator are multiplied more than a hundred-fold, thus insuring a degree of accuracy in electric explorations hitherto unattainable.

Because of unavoidable losses in measuring devices, it is impossible to detect very small field variations. The accompanying sketch shows the comparative efficiency of different types of measuring arrangements in regard to the corresponding indicator voltage of certain field variations.

The actual surveying is carried out by grounding an alternating current generator at two points and moving the exploring rod or the exploring coil systematically, for instance in checkerboard fashion, over the area to be investigated. If necessary these operations are repeated, using a current source of different frequency.

From the readings thus obtained the potential or the intensity and their phase angle values are computed and lines of equal potential variation and equal phase variation or lines of equal intensity variation and equal phase variation are interpolated, plotted, and interpreted as to their probable geological meaning.

Scientific exploration of alternating fields for geophysical purposes is impossible without modern ampli-



Curves showing comparative sensitivity when using untuned bridge, direct reading, and tuned bridge

fying devices. Unfortunately, the amplifying factor of these devices changes very easily. This disadvantage has no effect upon the carrying out of explorations with the new method, because the amplification employed is not for measuring, but only for detecting, purposes. Correct exploration requires further exact knowledge of the intensity and frequency of the current source at the moment of observation. The first requirement does not apply to the new method, because it is based upon comparative readings, which are practically independent of changes in the intensity of the current source. The second requirement is met by the arrangement that simultaneously with any balancing the frequency of the field is also determined.

The operation of the delicate though solidly constructed measuring devices and the working out of the necessary computations require a thorough electrical training and should, therefore, be entrusted to electric engineers; nevertheless, close co-operation between electric and mining engineers or geologists is necessary for obtaining the best results or the greatest benefit of the final interpretation.

The two outstanding features of the new methods are the application of alternating field principles and of most sensitive measuring arrangements, patents for which have been applied for. Development of these features has taken a number of years, and I believe that electric prospecting in this form is now becoming a valuable adjunct to the mining industry, even in many of those areas where its application has hitherto been impossible.

Discussion

"As a Lawyer Sees Mining"

THE EDITOR:

Sir—Taking into account the great esteem in which I hold your journal, I, too, was a bit shocked to read your "leaderette" entitled "Mining Success," in your issue of Nov. 13. The mining fraternity owe Mr. Russell a debt of gratitude for taking up this matter. Just three years ago this month, in an article that you were so good as to publish from my pen, entitled "Rich Ore," I animadverted on this same object. Administrators, metallurgists, and engineers, I said, there were in plenty; but not those who were also Miners! It has been clear to me for very many years that this is so; and the results consequent on it apply to properties which are much more than "prospects."

Over twenty years ago I introduced and sold the now famous San Francisco del Oro mine, near Parral, Chihuahua, to a London "group," for £200,000. It is today the property of the San Francisco Mines of Mexico, Ltd., and the year's profit at Sept. 30 last was £399,000. The profit since then (with an enlarged treatment plant) has been at the rate of about £500,000 yearly; say, $2,400,000 U. S. currency. It is the third or fourth biggest lead-zinc-silver mine in all the world —and is yet in its infancy!

Now, when as a young engineer of twenty-seven (but, I am thankful to say, a miner also) I first saw this property it had already, from its then almost exhausted surface or carbonate ores, made the substantial fortunes of at least two Mexican families and of one French family. Above Deep Adit it was then roughly estimated that there were about 250,000 tons of sulphide ores "exposed" (*not* "blocked out"), averaging 15 per cent lead, 27 per cent zinc, 26 oz. silver, and a little gold per ton. The main oreshoot was for just over half a mile in continuous ore of this character, averaging about 12 ft. wide. And this was but one of several parallel lodes, heavily mineralized right up to surface.

The country down there—in those days—fairly "swarmed" with "scouts" and "experts," representing practically all the big mining finance people of the United States, Canada, Great Britain, and western Europe: eager, all of them, to get a good thing for their employers. It was before this era of present-day "civilization," whose advance is connoted (so it seems to me) by murder, harlotry, and scientific graft, in the countries named. Among all these men of talent I only remember one or two who were really miners; who, truthfully speaking, knew anything at all about a mine!

Engineers there were in plenty, and of international repute; but they were engineers only.

These men all had the same stock objections:

1. The ore was "complex." This was a fact: there was not only the very intimate association of the lead and zinc mechanically, but there was a zinc-silver combination, chemically. Also, the lode matrix carried fluorspar.

Belgium, even then, however, was greedily buying such ores on not bad terms; and even *today* this San Francisco zinc concentrate is sold to Belgium.

2. The roughly 250,000 tons of these sulphide ores was "exposed"—often on two sides, but *not*, technically, "blocked out." Not possessing any mining "sense," nothing but ore "blocked" on three or four sides had weight with these gentlemen.

3. The price asked—$1,000,000 U. S. currency, half cash—was pronounced "outrageous"!

Here, then, was one of the three or four biggest and richest mines of its class in all the world; developed to the extent of having a quarter of a million tons of such high-grade ores fairly "exposed" above the adit; in ideal conditions, geologically, as regards depth and permanence; and with several other big lodes showing. But, with it all, the "mining talent," so called, of which I have written, just turned it down!

I sold it, subsequently, as I have said, for £200,000: £80,000 thereof in cash. The man, however, who was really impressed among the purchasers and who found most of the money was a chartered accountant of New York and London. He is now dead; but he was a man of courage and foresight: a wise, far-seeing, business man.

This experience opened my eyes. From then onward I have taken note that the world's mining schools turn out engineers—very capable men—in plenty: but miners—*real* "mining engineers," very, very few! They are getting scarcer every day, worse luck! Very soon, I fear, they will be quite extinct.

I should say, roughly, that nearly 90 per cent of our present-day "experts," to say nothing at all of "scouts," possess scarcely a "glimmer" of what I have called the "mining sense." Until ore actually is found and blocked out upon three or four sides for them by someone else, they have no true comprehension of what is the difference between the prospective mine and a hole in the ground!

Mining—mining proper—cannot, I feel sure, *be taught*. Engineering, metallurgy, and related subjects are exact sciences—mining is not an exact science; in the very nature of things, it never can be. Like art or music, the finding of ore is an instinctive "sense"; but one which experience, of course, amplifies.

Apart from the foregoing 90 per cent of ignoramuses in the above-mentioned respect (otherwise able and intelligent men), there is just that small class of *very* astute fellows who do know an embryo mine all right, but, once having found a soft job with some gravel-blind mining-finance house in New York or London, sit tight, draw princely fees, and turn down everything brought to them, on general principles—*sans* mercy and *sans* remorse. They take no risks, they say to their particular friends. Two men whose names are household words in the profession have said this in my hearing—more than once; and they all act up to it. This type of man is the consulting engineer to that still

wealthy but half-moribund "group" whose directors go on working almost exhausted properties first financed by their grandfathers—and which once were profitable. Their consultants literally dare not let them take up anything fresh, anything new. And—so strange a thing is humanity—their very directors and employers admire them! You may hear them say what "wonderful"—what "safe" men—these fellows are.

These, too, are the gentlemen who make up such a large proportion of the committees of technical societies and institutions—mutual admiration societies. They become, also—many of them—"all things to all men"; but to men, in this case, who have substantial bank balances. They send out these half-fledged "scouts" (if they do anything "active") of whom Mr. Russell writes—already instructed to follow on in their sacred footsteps, if they would live at all.

Hence, as Mr. Russell says, there are still many good prospects in Arizona; I saw some of them myself, last year. And not only in Arizona, for these things are to be found in every mining state in the American Union; over here in Cornwall, after all these centuries of mining; and in every mining region whatsoever, the world over. And, with the few exceptions that prove the rule, practically all "great" mines have had one or more parallel but "blind" lodes, which don't even come to surface. Many such great mines have been worked out, abandoned by experts without, for instance, adequate crosscutting; and years later reopened by practical men, to make bigger profits than ever.

It is *not* the mines, the good, new mines or the attractive "prospects," which are anywhere so really scarce: what are scarce (if I may conclude in Mr. Russell's own words) are "those men with money who have the brains, nerve, and foresight to really mine."

That puts it in a nutshell: men of the kidney of your late Senator Clark, and of our still living F. W. Baker, and a few more; year by year, alas, still fewer.

Britain remains solvent largely because of mining; because, luckily, London still is the world's banking center and general clearing house. This fact arises, no doubt, from long custom; from her geographical position; but, above all else, because she monopolizes the world's output of gold, of tin and, of course, of rubber. Four-fifths, or thereabouts, of these three commodities are controlled from London. That this is so, however, is due to the generation which is now passing and to its forebears. The young Englishmen of today, for the most part, are idle, incapable, and good for nothing. Quite a large proportion of young Americans (from what I saw last year) seem to be in the same case, though the proportion is less.

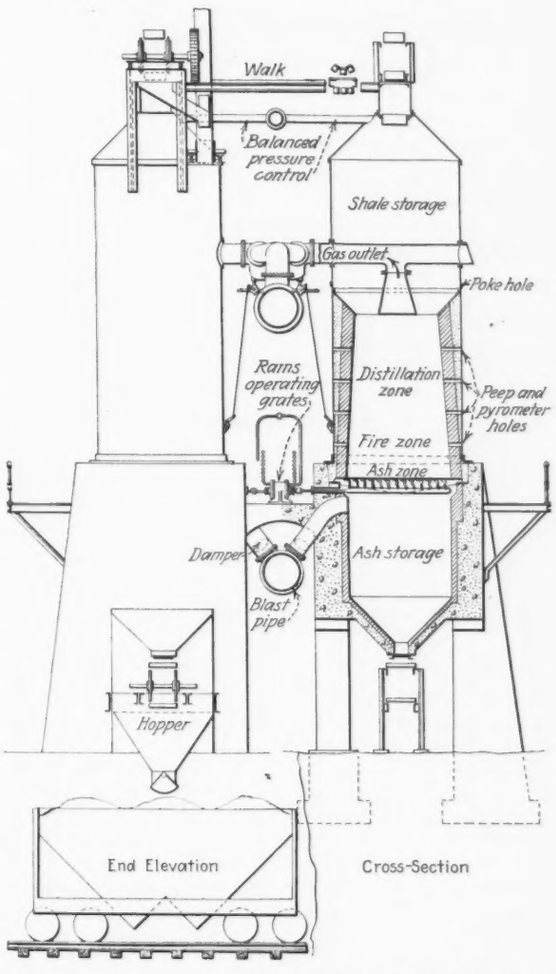
Liskeard, Cornwall, England. A. SPENCER CRAGOE.

The Catlin Oil Shale Furnace

THE EDITOR:

Sir—On page 1031 of your issue of *Engineering and Mining Journal* of Dec. 25 there appears an article on "An Adventure in Oil Shale." In the sixth line from the bottom of the first column of the article it reads "beneath the grate is a supplementary grate, which retards the downward movement of the spent residues." This is not strictly correct and should be eliminated.

There is only one main grate level. The grate bars are made strong enough to cut out green shale if necessary. There is, however, a single line of grate bars at each end at right angles to the main grates and above them, making it possible to cut along the end walls as well as the side walls of the square. This is desirable



Sketch showing construction of Catlin oil shale furnace

because of the tendency of the fire to creep up along the walls, where there are naturally more voids than in the mass. The furnace is shown in the accompanying illustration. R. M. CATLIN.

Franklin, N. J.

Lubricating Hoist Brake Blocks

THE EDITOR:

Sir—In connection with the subject to which reference is made in the caption heading this communication, as discussed in your issue of Jan. 1, I will say that I consider the lubrication of brake blocks for hoisting work to be bad practice and very detrimental. The lubrication very materially reduces the coefficient of friction between the brake blocks and the brake ring on the drum, and therefore it is necessary to apply the brakes with a great deal more pressure when they are lubricated.

I have seen brake blocks lubricated with various kinds of oil, and do not think that any particular oil presents an advantage over other kinds of oil that may be used for this purpose. The increased pressure required for lubricated brakes usually generates a great deal more heat than is generated by the lighter application re-

quired for dry blocks. I can see no reason why there should be any difference in practice as between a hoist used on the surface and one used underground, or between a hoist used at a metal mine and one at a coal mine.

In ordinary hoisting work around mines where the brake is used for stopping the hoist only, after the power has been shut off, lubrication can probably be dispensed with in the majority of cases, but for single-drum hoisting where the cage or skip is allowed to lower by gravity, thus making it necessary to apply the brake for the entire down trip, a great deal of heat is generated—so much so that at times the blocks are scorched. It is obvious that these brakes do not have sufficient area in contact with the brake ring. Such faulty design of brakes is frequently found on small types of standard hoists. In the interests of economy and competition, the hoist builder has made the brakes too narrow.

On very large hoists such as are used at deep shafts where the hoists are designed especially for the work to be done, I have never seen the brake blocks lubricated and I have never seen them burn. They are designed with sufficient area to give a low unit bearing pressure.

In one notable instance of a large lowering engine where a very heavy load was lowered on a steep incline, about 7,000 ft. in length, the brakes got very hot and burned the wood when unlubricated. Then the brake blocks were lubricated and the brake ring became very hot during each trip, owing to the excess pressure necessitated by the reduced coefficient of friction, and the brake ring was cooled by having a 2-in. stream of water turned on to the inside of it. This practice was followed, in this case, for many years.

It might be well here to call attention to some of the faulty details of design of brakes and some of the methods of ameliorating the conditions created by poor and inadequate brakes. Where electric hoists are used, the wear on brake blocks may be materially saved by permitting the motor to act as a brake by running backward and generating a current which is fed back into the main supply lines. This system is probably coming into greater use where gravity lowering on single-drum hoisting is employed.

In one instance, in the operation of an incline—about 6,000 ft. long—used for lowering coal to the bottom of a valley, to obviate the necessity of applying the brakes for the entire trip, a large four-bladed fan was geared to the hoist. This fan in churning up the air acted as a brake. The brakes in this case were used only when it was desired to stop the load, and when the brake was released the load started on its downward trip and the speed was controlled entirely by the fan.

Any hoist should have wide brakes, and the angle of contact should be as wide as possible, thus giving a large area of contact and a consequent low unit pressure on the brake blocks. When the hoist brakes are properly designed, there will be no necessity for lubrication under any conditions.

Not so many master mechanics, or even hoist builders, understand the correct designs for brakes or the correct manner in which the brake blocks should be applied. In the case of post brakes it is necessary to take into consideration the width of the brake blocks only. The angle of contact, moreover, for each brake shoe should be not less than 90 deg. When each post-brake block has an angle of contact greater than 90 deg., the few extra degrees at each end add but little to the efficiency of the brake. In the case of band brakes the angle of contact should be as great as possible. This makes the brake easier to apply, gives greater bearing area, and relieves the shaft from unequal pressure, but the width of the brake should not be slighted.

Brake blocks should be made of some material that has a high coefficient of friction. Bass wood or poplar are the best materials for wooden brake blocks. The brake blocks should be so cut that the grain of the wood runs around the brake ring and not across it. Hardwood such as oak or maple does not make good brake blocks, as the woods named take a high polish and have a low coefficient of friction. End wood of any kind makes poor brake blocks.

There are several different materials especially made up for use on brakes. Among them are the different woven fabrics, such as are used on automobiles. These fabrics as a rule have a high coefficient of friction and withstand greater wear than any wood.

As stated previously, the principal reason for lubricating brake blocks is to prevent heating, and lubricating is necessitated by narrow blocks or insufficient area. Heating can best be prevented by giving the brakes sufficient bearing area.

J. A. THOMAS.

Los Angeles, Calif.

Consultation

Chromite from Rhodesia

"I understand that the principal source of the world's chrome ore is Rhodesia. Can you tell me something about the industry?"

The deposits from which the greater part of the chromite comes are situated along the Great Dike in Southern Rhodesia. According to H. B. Maufe, Director of the Geological Survey of Rhodesia, the deposits are of two distinct types: (1) Irregular bodies, often more or less lens-shaped, in serpentine and talc schists derived from metamorphism of basic and ultra basic rocks of the Archean system. These bodies are located by trenching and are worked by quarry methods. Actual reserves are hard to measure and no estimate has been attempted. (2) As regular seams, usually from 4 to 10 in. thick, in a body of basic and ultra basic rocks of dike-like habit, 33 miles long and 4 miles wide. In places there are two or three seams separated by about 200 ft. of rock. They may join at depth.

Outcrops have been traced for more than six miles continuously. The tonnage doubtless is enormous, though it cannot be intelligently expressed in figures. Moreover it is uncertain as to how much of the available material could be profitably exploited at current prices. Shipments heretofore have been from open-cut workings situated about 15 miles from the railroad, and the possibility of working the more remote deposits and those requiring underground mining remains to be determined. Production in 1924 was 172,724 tons, and in 1925 about 135,830 tons. The decline is attributed to washout along the Beira railway. Estimates of production in 1926 range up to about 170,000 tons. The Vanadium Corporation of America is said to have acquired chrome holdings in Rhodesia.

News of the Week

Summary

BUREAU OF MINES budget has hard sledding; reduced $600,000; scientific work hampered; disregard of Reynders committee recommendations.

Modern mining and milling methods applied to North Carolina feldspar deposits, aided by availability of electric power.

North Butte shows profit—Dahlonega mines, in Georgia, may be reopened, after thorough sampling.

San Rafael shipping better ore—Dynamite struck by locomotive fails to explode.

West End Consolidated shipping $125 ore.

Urquhart issues statement on Soviet confiscation of mines and failure to meet British claims for £56,000,000.

Ore shipments to Trail smelter 165,114 tons in 1926—Canadian mineral production in 1926 exceeds 1925.

Manganese production in India declines; local producers not able to finance export.

El Boleo Copper reported to have been refinanced; development proposed.

Mount Morgan considering steam shovel methods—Mount Lyell profits low.

Delaware completes purchase of Rex Consolidated.

Nearly $600,000 Cut from Budget Requirements of the U. S. Bureau of Mines

Appropriations for Important Work Eliminated or Reduced by Official Disregard of Reynders Committee Recommendations—Turner, Oddie, and Pittman Contend for Restoration of Items Affecting Safety and Research

By Paul Wooton

THAT the U. S. Bureau of Mines is not responsible for the scant attention given the mining industry in connection with the appropriations for the next fiscal year has been revealed by the Senate Committee on Mines and Mining. At a public hearing held on Feb. 9 it developed that the Bureau, after having made a careful and detailed estimate of its urgent needs, requested appropriations totaling $2,504,100. When this request reached the Department of Commerce the financial officials there reduced the amount by more than half a million dollars before the estimate was submitted to the Bureau of the Budget. The Budget Bureau lopped off nearly $100,000 more.

For work on the economics of mining, which had been recommended so strongly by the committee headed by J. V. W. Reynders, the Bureau asked $325,210. The department reduced this by $30,210 before it went to the Director of the Budget. The director then made a further reduction of $70,000, and the House Committee on Appropriations gave all new economic work the coup de grace by cutting out the remaining $30,040.

When the budget reached Congress and it was seen that the work of the Reynders committee, which was representative of all branches of mining, had gone for naught, Senator Oddie, of Nevada, chairman of the Committee on Mines and Mining, acting in that capacity and on behalf of a number of Senators from mining states, immediately took steps to secure more recognition for the mining industry. The very large requests which were being made for agriculture emphasized the failure of federal officials to recognize their obligation to the other basic industry. This led to the introduction of a bill proposing a few modest increases for the Bureau of Mines. Specifically they are: For the study of prospecting methods and devices based on gravitational, magnetic, seismic, electrical, radioactive, geothermal, and other phenomena to indicate the presence of hidden mineral bodies, $25,000; economic studies of silver, $10,000; economic studies of gold, $10,000; economic studies of iron, $20,000; one mine rescue car, $45,000; replacing obsolete oxygen breathing apparatus, $10,500; testing for permissibility of electrical equipment for underground use in gaseous coal mines, $15,000; for investigating and testing explosives used in metal mining, $10,000; for the investigation of falls of roof and coal, $10,000.

As Senator Oddie had called the attention of the Senate as a whole to the need for these appropriations and had appeared personally before the Senate Committee on Appropriations, and had not been successful in obtaining any of these increases, he called his committee together for the special hearing. Following the hearing, the committee recommended that the foregoing increases be granted and urged the Senate to pass the bill. The action of the committee simply authorizes these expenditures, but every effort will be made to secure the actual appropriations before adjournment. In all probability the fight for this money will have to be carried to the floor of the Senate. It is understood that Western Senators expect to point out at that time that certain federal officials seem to be lacking in appreciation of the value of the industry which creates almost as much new wealth every year as does agriculture. Senator Pittman brought out, in striking fashion, at the hearing that the agricultural appropriation act, approved Jan. 18, carried $3,682,491 for studies of the economics of agriculture.

At the request of the committee J. Walter Drake, Assistant Secretary of Commerce and its chief financial officer, was asked by what process of reasoning he reduced the preliminary estimates of the Bureau's staff of technical men, who are thoroughly versed in the needs of the industry. Assistant Secretary Drake admitted that he is not a mining engineer and explained that "the only reason these items were not pushed more vigorously by the Department of Commerce in connection with the estimates was that we had to take all the bureaus of the Department of Commerce, with their large number of projects and activities, and set up some sort of balance which in our judgment would come within the amount which the Bureau of the Budget proposed to allocate to the Department of Commerce."

Assistant Secretary Drake, in response to questions by the members of the committee, gave detailed figures showing that the amounts asked for by the Bureau of Mines had suffered both at his hands and at the hands of

the Director of the Budget. Having established that Mr. Drake was not qualified to grasp the entire importance of the work proposed by the technical men in the Bureau of Mines, Senator Oddie asked if these appropriations came before an official of the Budget Bureau who is experienced in mining. Mr. Drake replied that the proposed appropriations had been discussed before Major Jones, who is an army man. Major Jones and General Lord, Mr. Drake said, have to consider a very large number of subjects, in many cases highly technical, and it was not to be expected that they themselves could become experts in every direction. Senator Pittman asked how much the budget cut down the appropriations of the entire department. Secretary Drake replied that the cut was 10 or 15 per cent. "Suppose your department was cut 10 per cent by the Bureau of the Budget," Senator Pittman queried. "Then it comes down to your discretion as to where to put that cut." Mr. Drake admitted that that was the case. Senator Pittman then said that "it looks to me as though human life has suffered more than science in this cut by you. It would seem that in all that great appropriation there could be reductions made that would not be nearly as serious as a reduction in a life-saving enterprise." Senator Oddie asked for the figures under the "falls of roof" item. Director Turner replied: "Our request was for $15,000. The previous year we had $7,500. We have been allowed $2,500 additional this year, making a total of $10,000. So we are allowed two-thirds of our request on that."

Assistant Secretary Drake explained that "there are a large number of other appropriations for the Department of Commerce that involve considerations of safety."

NEED OF FEDERAL SURVEYS STRESSED

Director Turner, at the request of the committee, explained the need for the various items. In connection with geophysical methods of prospecting he said in part: "These methods do not give the assay value of the ore. They only serve to indicate favorable places for prospecting with diamond, churn, or rotary drills or trenches, pits, or shafts. Their principal value at the present state of development is to eliminate unpromising ground and to make possible concentration of efforts on promising ground. When I first came to the Bureau of Mines a year ago I thought there was a splendid chance for the Bureau to take the lead in this matter. The year before these methods had given extraordinary promise. During this year they have gained ground steadily and rapidly. The Bureau of Mines is in the rear of this movement. It should be in the lead. The reason why some impartial body should study these devices is that each one is now being developed and pushed under certain patent rights. The claims of the exploiters are all favorable to their own devices. There has been no impartial analysis of the relative advantages of the different methods or of the principles which underlie them. We believe the Federal Government should survey this whole field."

Senator Oddie asked whether, if the Bureau should receive this proposed appropriation, it would be used in protecting the public against fradulent devices. Director Turner said that this was one of the important reasons why the Bureau should study the subject. He explained the need for a new mine rescue car to replace one worn out in the service. He also explained that sparks from electrical devices underground are particularly dangerous and cause many accidents. He stated that some manufacturers do not have the facilities to make sure that their devices are spark free. Some years ago the Bureau built a large steel gallery in connection with its Pittsburgh experiment station, in which electrical equipment is tested in gaseous atmospheres. Full-sized machines such as are to be sold to the user are tested in the exact atmosphere that may be met in the mine. When this work started there was no demand for it. The advantage of the service is so apparent, however, that the Bureau now is in the position of having created a demand which it cannot supply.

It is believed that Secretary Hoover took no personal part in the consideration of the estimates of the Bureau of Mines. In delegating budget work to his financial officers, he probably feels that he should not intervene in behalf of this or that item, but in the Bureau of Mines case, he may have felt unusual restraint, as the creation of the economical branch had been widely heralded as a sort of monument to perpetuate what his administration had done for the Bureau.

The table presented herewith sets forth just what happened to the estimates of the Bureau of Mines, intended to carry out the recommendations of the Reynders' committee. It will be noted that the amount allowed by the budget this year is $53,340 less than the total appropriated for the current fiscal year. Cuts made prior to the submission of the Budget usually are secret, but the Senate Committee on Mines and Mining required the presentation of this information.

Appropriation Item	Bureau of Mines Appropriations for 1927	Preliminary Estimates of the Bureau as Submitted to the Department of Commerce	Bureau Estimates as Revised After Conference with Department of Commerce	Bureau Estimates Authorized by Department of Commerce for Submission to the Bureau of the Budget	Bureau of Mines Final Estimates as Authorized by the Bureau of the Budget
General expenses	$84,680	$88,280	$86,280	$86,000	$86,000
Investigating mine accidents	403,500	481,370	448,130	395,630	390,630
Mining investigations in Alaska	10,860	10,860	10,860	10,860	10,860
Operating mine rescue cars and stations	277,380	332,480	332,480	277,380	277,380
Purchase mine rescue car	.....	45,000	45,000	.....	.....
Testing fuel	154,000	199,000	184,000	155,860	154,000
Mineral mining investigations	148,660	215,400	200,400	112,070	99,570
Oil, gas and oil-shale investigations	211,000	233,000	233,000	203,660	198,260
Oil-shale investigations	89,000	Balance	Balance	Balance	Balance
Expenses mining experiment stations	173,000	183,000	183,000	173,000	173,000
Care, etc., building and grounds, Pittsburgh, Pa	64,320	105,500	95,500	71,360	71,360
Maintenance and operation, government fuel yards	Balance	Blanace	Balance	Balance	Balance
Mineral resources	123,000	.....	.....	.....	.....
Helium investigations	75,000	85,000	75,000	75,000	75,000
Promoting mineral commerce	.....	325,210	320,210	295,000	225,000
Helium production	.....	100,000	.....	.....	.....
Potash investigations	100,000	100,000	100,000	100,000	100,000
Totals	$1,914,400	$2,504,100	$2,315,860	$1,955,820	$1,861,060

El Boleo Copper Company to Spend Large Amount

The El Boleo Mining Co., property of the Rothschilds, of Paris, France, with holdings at Santa Rosalia, Lower California, is opening a $100,000 development and exploitation program, driving several new shafts, and taking in new mineralized lands, says a report received from Guaymas. The mills are being enlarged, and several hundred additional workmen are expected in from Mazatlan, Sinaloa. El Boleo was reported recently as having been refinanced, the Rothschilds retaining control.

Jack Harrington Gets Verde Extension Contract

The Verde Extension shaft at Warren, which will be sunk to a depth of 1,000 ft., will be put down by Jack Harrington, of Miami, to whom the contract was recently awarded. Mr. Harrington recently completed the sinking of the McIvor shaft, at Oatman, and expected to start work on the Verde Extension shaft not later than Feb. 12. The sinking of the shaft is one of the first steps in a large development program planned by the company.

Mr. Harrington sank the Porphyry shaft of the Inspiration Copper Co., and also the Old Dominion shaft, at Globe, and a shaft for the Kay Copper Co., at Canyon, Ariz. He recently made a record in sinking a shaft for the Sunnyside Consolidated Mining Co., at Oatman, Ariz.

West End Con. Shipping $125 Ore

The West End Consolidated Mining Co. reports that Lot No. 66, from its Mabel mine, near Mina, Nev., ran 1.54 oz. gold, 140.06 oz. silver, and 8.55 per cent lead, a total gross value of $125.04 per ton. The ore was stoped from the 300 to 500 levels. The vein continues small and irregular in value, but by careful sorting a shipping grade can be produced. The ore contains lead, some zinc, and some copper, so it cannot be treated at the Tonopah plant of the West End Co.

Dahlonega Gold Mines May Be Reopened

According to the *Atlanta Constitution*, an effort is under way to resume gold mining in Lumpkin County, Ga. The low-grade gold mines of this county have been worked intermittently for 100 years and finally abandoned, having attained a depth of less than 400 ft., slightly below permanent water level. William D. Grant and Graham G. Dugas have formed the Dugas Corporation, Dahlonega, Ga., and are reported to be cleaning out and sampling the old workings. They also plan to open the mine by a long tunnel to tap the orebody below the present workings. A cyanide plant is proposed.

Micolithic Company Expands

The Micolithic Products Co., of Houston, Tex., will build a plant in Houston, estimated to cost $70,000, for the grinding of a highly siliceous product for refractory purposes. This company's mine is on the line between Hudspeth and Culberson counties, Tex., about 120 miles east of El Paso. The company is building a railroad, 7 miles long, called the Rio Grande & Northern, from the main line of the Southern Pacific Railway south to the mine. This may be completed by March 1. A plant for grinding stucco and cement floor surfacing and concrete block- and brick-facing products is being built at the mine.

New Mill for Minto Mines

Dr. J. Mackintosh Bell, head of the Pioneer company, has announced that a mill is to be built at the Minto mines, Michipicoten, Ontario, this year. No details have been given regarding the size of the mill, but it is expected that it will start with a capacity of 150 tons daily.

San Rafael Shipping Better Ore

The San Rafael Mining Co., operating at Quartz Mountain, Nev., is shipping twenty-five tons of ore per day to Utah smelters which will average from $35 to $50 per ton. Values are in gold, silver, and lead. Gold values have heretofore been small, but recent ore opened between the 250 and the 350 levels shows an appreciable increase in gold content.

At the Calico mine, northwest and adjoining the San Rafael, the 300-level station is completed and a west crosscut has been started. At the Quartz Mountain Metals, southeast of the San Rafael, retimbering of the 110-ft. shaft has been completed and sinking started. It is planned to sink to the 300 level and do lateral work at that elevation before sinking deeper.

Mohawk Ships 2,500 Tons Daily

Mohawk, at Mohawk, in the Michigan copper district, is producing at 95 per cent of capacity, copper-rock shipments running about 2,500 tons per day. Rich ground continues to be opened in No. 6 shaft, with all faces in high-grade rock, and good-grade rock also is being mined in No. 4.

Chalk Mountain Plans Mill

The Chalk Mountain Silver-Lead Mines Co. has shipped another car of silver-lead ore from its Chalk Mountain, Nev., property. E. M. Dawes, manager of the company, recently returned from a conference with eastern stockholders and states that they are favorable to building a milling plant to work the large tonnage of developed ore which will not stand the high cost of truck transportation and smelter treatment.

Preliminary metallurgical test work is now being conducted to develop data that will make possible an early definite conclusion as to the best milling process, as construction may be started in the spring of 1927. Work on the 500 level has disclosed some ore of shipping grade, but after drifting for 50 ft. the drift passed into broken ground showing low values in small stringers.

Canadian Mineral Production in 1926

According to the Dominion Bureau of Statistics, the mineral production of Canada for 1926 established a new high record, with a total value of $242,886,000, as compared with a previous high of $227,860,000. Estimated production of certain minerals in Canada in 1926, and comparative figures for 1925, follow:

Metals	1926 Value	1925 Value
Gold	$35,749,000	$35,880,000
Silver	13,618,000	13,971,150
Nickel	14,401,000	15,946,672
Copper	19,270,000	15,649,882
Lead	22,911,000	23,127,460
Zinc	10,845,000	8,328,446
Other metals	3,087,000	4,177,862
Totals	$119,881,000	$117,082,298
Non-metals		
Coal	$58,164,000	$49,261,951
Asbestos	9,777,000	8,988,360
Natural gas	7,841,000	6,833,005
Gypsum	2,530,000	2,389,891
Petroleum	1,335,000	1,250,705
Salt	1,450,000	1,410,697
Other non-metals	1,908,000	1,717,192
Totals	$83,005,000	$71,851,801
Structural materials and clay products		
Bricks and other clay products	$13,200,000	$14,046,704
Lime	11,000,000	9,529,691
Stone, sand and gravel	4,000,000	3,387,652
Totals	$28,200,000	$26,964,047
Grand total	$242,886,000	$226,583,333

North Butte Shows Profit

The management of the North Butte Mining Co., Butte, Mont., reports that the company is showing a substantial profit from the leasing operations on the "Granite Mountain" and "Speculator" claims. The company has a large crew working at its East Side property, installing more than $17,000 worth of 10-in. water column in the Main Range shaft. Two 600-gal. electric plunger pumps will be installed on the 2,200 level and a like unit on the 1,200 level. According to Paul A. Gow, general manager, this should be sufficient to take care of any additional water that may be encountered in cutting the copper veins east of the Continental Fault on the 2,200 level. Dan McGrath, formerly State Mine Inspector, is superintendent of the East Side operations.

Gold Circle Cyanide Plant Nears Completion

The 100-ton cyanide plant of the Gold Circle Consolidated Mines Co., at Gold Circle, Nev., will be ready for operation by March 10. Some time ago this company, under the leadership of its president and manager, N. H. Getchell, effected a consolidation of most of the near-in desirable ground in the district. This included property on which a large amount of development work had been done and production from which had provided ore for a 75-ton mill for several years. The veins are not large, but contain a substantial tonnage of ore of excellent grade.

Gold Zone Makes Test Shipment

The Gold Zone Divide Mining Co., which controls and operates the General Thomas mine, in the Lone Mountain mining district, about 12 miles from Tonopah, Nev., has shipped a test car of lead-zinc-silver ore to a Utah smelter. The General Thomas mine is an old one from which a large production of lead-silver ore was made prior to the early days of Tonopah. About two years ago a group of Tonopah men proceeded with mine development and placed a small concentrating plant on the ground. This group disposed of its interests to the Gold Zone Company, which is making a determined effort to develop the mine properly.

The sulphide ore now being shipped is from a new orebody recently discovered.

Standard Graphite Enlarges Mill

The Standard Graphite Corporation, Glendale, Calif., is enlarging and modernizing the mill to care for the products in the most economical and efficient manner. W. A. Kunkle, general superintendent, is in charge of all improvements at both mine and mill. The mine is on the north slope of the Verdugo Hills, 18 miles north of the city of Los Angeles, at an elevation of 800 ft. above sea level. The ore contains high carbon content in crystalline graphite and much good-sized tough flake. Mining is done mostly by open-pit or surface work, but the deeper deposits will require underground workings. General E. B. Babbitt, of Santa Barbara, is lessee of the property and sole operator.

Dynamite Fails to Explode When Struck by Train

Modern dynamite is hard to explode, and when kept free of blasting caps is fairly safe to transport and handle, as was recently demonstrated in Ely, Nev., in a spectacular and nerve-racking manner, when a truck loaded with 44 50-lb. boxes of 40 per cent dynamite was struck by a locomotive of the Nevada Northern Railroad. The truck was almost demolished, the powder was scattered, and some of the sticks here run over and crushed by the wheels of the locomotive. No explosion occurred even with this harsh treatment, which was fortunate, as the accident occurred within danger distance of many people.

North Carolina Feldspar Mining Making Progress

Modern Milling Methods Applied—Electric Power Gives Impetus to the Industry—Ceramic Industries Attracted

THE Spruce Pine feldspar district of North Carolina covers an area approximately 12 miles in width by 32 miles in length in Yancey, Mitchell, and Avery counties. It extends northeast from the range of mountains which includes Mount Mitchell, 6,711 ft. high, covering much of the watershed of the Toe River.

The first carload of crude feldspar was shipped from this district in 1911. Since then the quantity mined there has increased rapidly. Total shipments from the district in 1926 were around 80,000 tons, or about 40 per cent of the feldspar mined in this country. Present indications are that shipments will increase for years.

Though the district has great feldspar resources, only a few large deposits have been found. These are in the hands of well-established concerns. The market for the finished product is so well supplied by the present producers that there is little incentive for new capital to enter the business.

Most of the known deposits vary greatly in both physical and chemical analyses. This applies not only to different mines, but in a short distance in a single deposit it is common to find considerable variation. Mica, quartz, and other foreign materials occur irregularly. Production of a uniform finished product on a considerable scale is not easy under these conditions, and for some years the mining operations were carried on in a limited way. As a result, North Carolina feldspars acquired a reputation of lack of uniformity. The presence of foreign materials also was a handicap in meeting competition from fields where producers had had more experience. In the last few years improvements in the local production methods have gone far toward correcting the wrong impressions of the trade. The Tennessee Mineral Products Co., with a plant established at Bristol, Va.-Tenn., five years ago, has had a large part in proving that uniformity is commercially obtainable from North Carolina feldspars. Based on the experience gained in that plant, the new plant at Spruce Pine is so equipped and operated that uniformity can be assured for any one of several grades of ground feldspar. In fact, practically any analysis within the range of the raw material can be produced in such quantities as may be required.

The company's property consists of an aggregate of 2,000 acres in the heart of the feldspar area. Six mines are being operated, the largest of which is Deer Park No. 5, containing a very large deposit of high-potash spar (orthoclase). A typical analysis of the product is as follows: SiO_2, 67 per cent; Al_2O_3, 18; K_2O, 12; Na_2O, 2½. The deposit is not fully developed, but present openings show a width of 80 to 100 ft., a length of 250 ft., and a depth of 200 ft. The vein is a giant pegmatite, the crystals of feldspar, quartz, and mica being several feet or even yards across and segregated into groups. The separation of pure feldspar by selective blasting is partially accomplished in the mine and completed by hand on the picking belt at the mill.

Of the other deposits being mined, one is a high-grade soda spar (albite) analyzing SiO_2, 71 per cent; Al_2O_3, 18; Na_2O, 8; and K_2O, 2 per cent. With these extremes of chemical composition and the facilities for segregating or combining them any desired commercial requirement may be met.

Special products are prepared according to the specifications of the individual customer as to analysis and grinding. The following is a partial list of products: dental enamels, electrical porcelain, whiteware (dishes and the like), tile, sanitary porcelain, cast-iron enamels, sheet-iron enamels, glass, and abrasives.

An article summarizing the status of grinding feldspars from the Spruce Pine district at Bristol, Va.-Tenn., and Erwin, Tenn., appeared in *Engineering and Mining Journal*, Oct. 30, 1926. The grinding plants there described were located at those points, instead of near the point of production of the raw material, because there was then no power available in the district. Since then, the Carolina Power & Light Co., a subsidiary of the Electric Bond & Share Co., has started the construction of a 60,000-volt transmission line from near Asheville, N. C., to Spruce Pine. The completion of arrangements for supplying ample power will result in the location at or near Spruce Pine of all of the plants grinding feldspar from this district. This is due to the fact that there is no milling-in-transit rail freight rate. The freight differential in favor of shipping the ground feldspar from Spruce Pine to the main points of consumption in Ohio and New Jersey thus becomes very important. There is added the elimination of one loading and unloading, and a saving of a loss of about 5 per cent in transit.

Another development that appears likely is the location at or near Spruce Pine of some of the ceramic industries

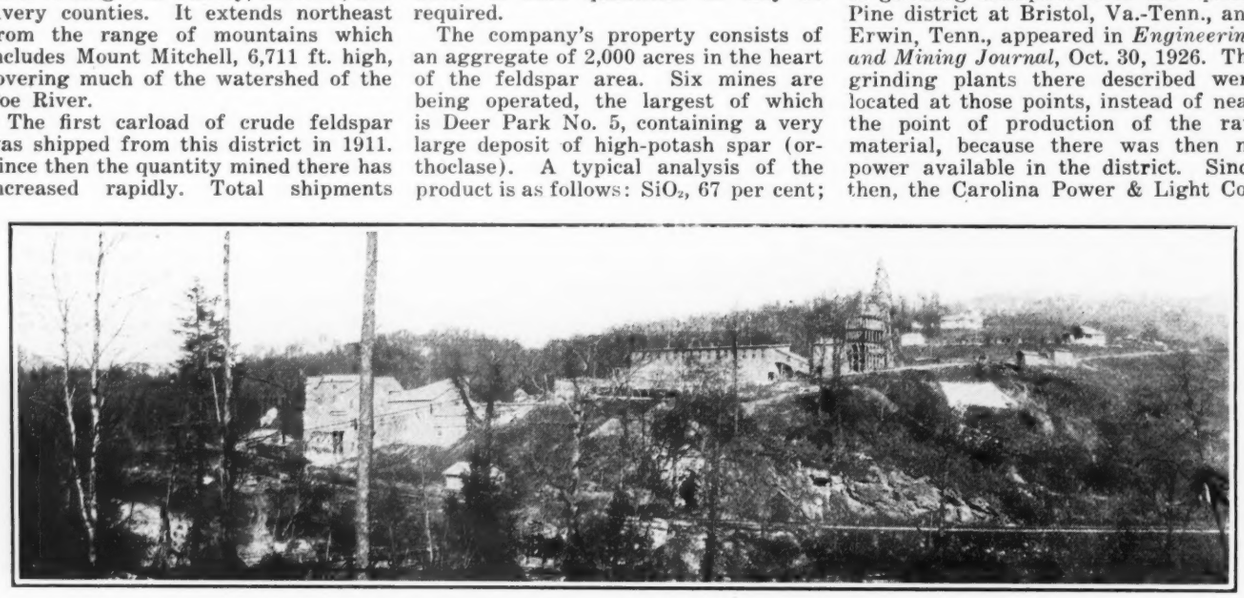


Fig. 1—Panorama of plant of Tennessee Mineral Products Co., Spruce Pine, N. C.

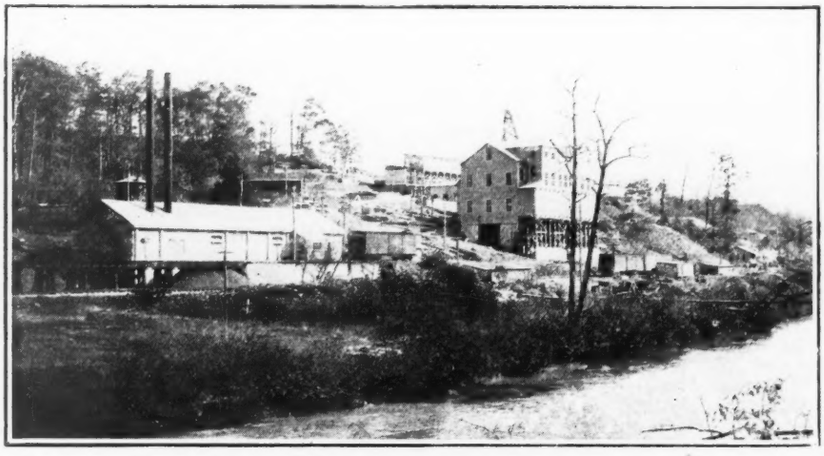


Fig. 2—Power house (left) and main mill building (right), Spruce Pine, N. C.

that use feldspar. Spruce Pine has in recent years become the production center of the primary kaolin, or "china" clay, mining of the country. There are ample local supplies of quartz and other materials used in various ceramic industries. Because it is located on a trunk line of the Atlantic Coast Line and the Louisville & Nashville Railway, with eastern Kentucky coal available at low cost, the Spruce Pine district should increase rapidly in importance as a finishing center for the feldspars, kaolin, and other raw materials which have heretofore been shipped out in the crude state.

Snowshoe Preparing to Resume

J. R. Villars reports that the Northwest Silver-Lead Co., which has a lease on the old Snowshoe mine, at Libby, Mont., is putting the property in condition and expects to be able to ship during the present year.

Porter-Idaho Ships High-Grade Ore

The annual report of the Porter-Idaho Mining Co., which is operating a mine on the north fork of the Marmot River, in the Portland Canal mining division of British Columbia, shows that the company shipped 174 tons of high-grade during 1926, from which it received a gross return of $45,201 and a net return of $40,550. The ore contained 16.39 oz. of gold, 73,779 oz. of silver, and 120,448 lb. of lead. Shipping has been suspended during the winter months, but development is being continued.

During last year the company did 885 ft. of drifting, 65 ft. of sinking, and 161 ft. of crosscutting. It is probable that an aërial tramway will be erected during the coming summer. The mine is situated at a high elevation, and ore has to be freighted down the mountain on pack trains. It costs about $50 per ton tidewater.

Fig. 3—Feldspar (white) deposit (120 ft. high) in Deer Park mine, Spruce Pine, N. C.

Ore Shipments to Trail Smelter in 1926

An analysis of the ores and concentrates shipped to the Trail smelter during 1926 shows that, exclusive of the mines owned and operated by the Consolidated Mining & Smelting Company of Canada, 116 mines contributed 165,144 tons of ores and concentrates. Of these 45 in the Slocan-Ainsworth-Lardeau district contributed 69,139 tons; 25 mines in the Boundary district, 36,327 tons; 11 mines in the East Kootenay district, 21,171 tons; 13 mines in the Nelson-Arrow Lakes district, 17,561 tons; 8 mines in the State of Washington, 17,015 tons; and 13 mines in scattered parts of British Columbia, 4,028 tons. The largest individual shippers were: Copper Mountain, Allenby, 32,632 tons; Lucky Jim, Zincton, 19,514 tons; Stemwinder, Kimberley, 18,487 tons; Bluebell, Riondel, 17,944 tons; Yankee Girl, Ymir, 16,541 tons; Whitewater, Retallack, 10,271 tons; Quilp, Republic, 8,746 tons; Last Chance, Republic, 6,050 tons; McAllister, Three Forks, 5,788 tons; Silversmith, Sandon, 3,916 tons; Cork-Province, Zwicky, 2,127 tons; Trevitt, Republic, 1,877 tons; Aurora, Aldridge, 1,817 tons; Henderson, Smithers, 1,622 tons; Homestake, St. Louis Creek, 1,584 tons; Galena Farm, Silverton, 1,262 tons; Ruth-Hope, Sandon, 1,241 tons; Sally, Beaverdell, 1,130 tons; Bell, Beaverdell, 1,035 tons; and Metals Recovery, Retallack, 1,021 tons. The Consolidated company's group of mines shipped 366,601 tons, bringing the total receipts up to 531,745 tons.

The Consolidated Mining & Smelting Company of Canada has introduced a new lead schedule, the chief difference from the old schedule being that in future the company will pay for 92.5 per cent, instead of 90 per cent, of the lead contained in ores and concentrates.

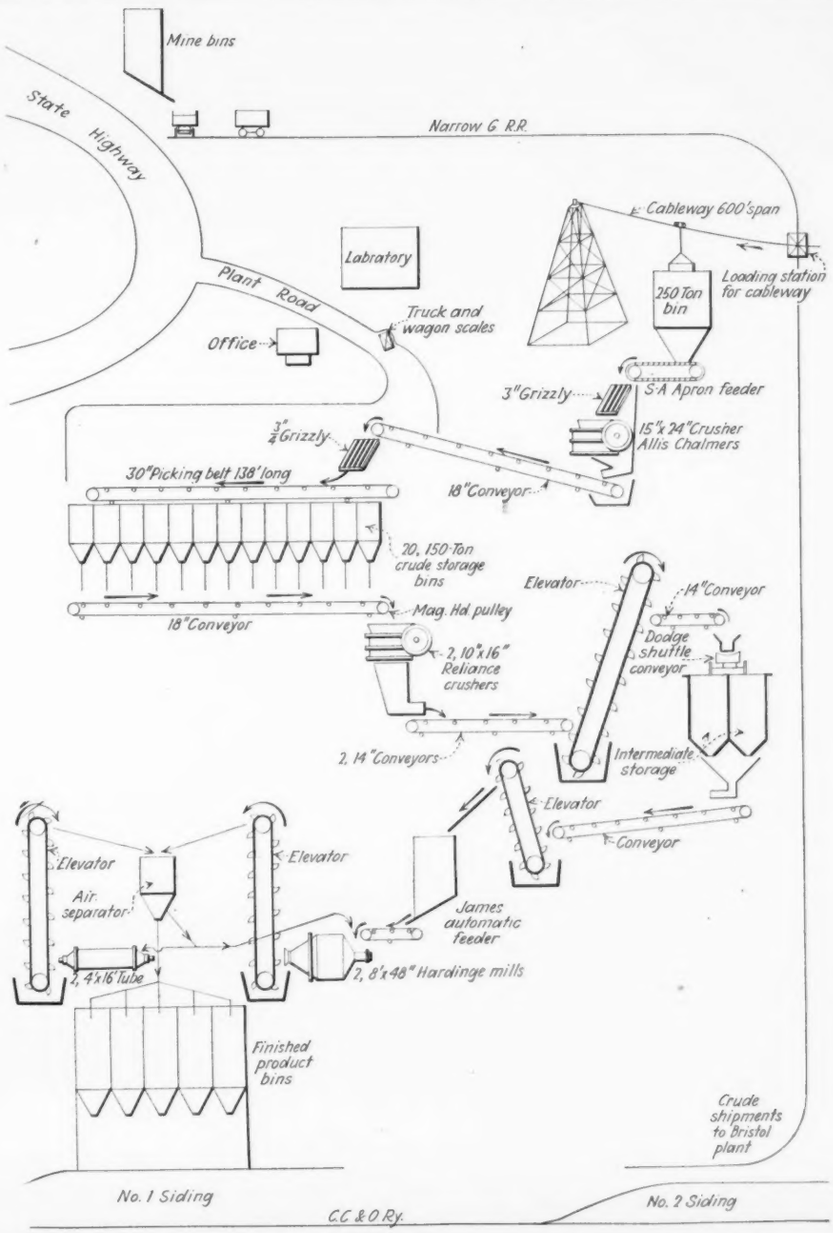


Fig. 4—Flow sheet of feldspar milling plant, Spruce Pine, N. C.

Calcutta Letter

By S. B. Banerjea
Special Correspondent

Local Ore Producers Not Usually Able to Finance Exports—Manganese Output Lower

Calcutta, Jan. 10.—American business men transact their business with India mainly through two American banks which operate branches here. One of them, the International Banking Corporation, has been operating as a branch of the National City Bank of New York for some time. Effective from Jan. 1, the authorities of the last-named bank began operating the former, as their local branch. The change in name will not involve any change in personnel or staff. With the increase in its capital stock, which will take place at the annual meeting of the stockholders on Jan. 11, 1927, the capital, surplus, and undivided profits of the National City Bank will be about $140,000,000.

From time to time, American merchants address the Director General of Commercial Intelligence, Calcutta, for the names and addresses of persons who have for sale minerals or metals in which they are interested. His lists are not complete in all cases. As they do not know the conditions here, it should be remembered that the mines are mainly owned by Indians. They do not, in every case, operate them themselves. They lease them out to enterprising Indians or Europeans, who pay them a royalty on a fixed scale on all shipments. Very few Indians have the necessary funds to carry on an export trade. They quote only for delivery at rail-head station, or Howrah, or K.P. docks, or Madras port, or Bombay port, as the case may be. The American buyers should arrange through agents in India for railroad freight, loading of steamers, and other related services. The American Express Co. has been operating in Bombay and Calcutta for a number of years and may, therefore, be able to look after such matters. To ask the Indians to do the needful for them is useless. The other day an American firm which is interested in bauxite asked me to secure a seller for them. I arranged a 7,000-ton lot, but the sellers refused to take the trouble of loading the ore at K.P. docks or Bombay. The American firm insisted on a f.o.b. rate, with the result that the deal fell through.

As for local Europeans, they prefer to deal through well-known American firms, or with houses recommended to them; but in the case of dealing with unknown parties, they insist on full payment in India against shipping documents through some British bank operating in India. Those American firms, therefore, which want to deal with Indian mineral merchants or British mineral exporters should arrange for dispatch through the American Express Co., or some other shipping agents, and open an account with the American Express Co. or the National City Bank's branch in Calcutta or Bombay.

The few commercial papers in India are of no use to American buyers, as they publish extracts from other papers, and their news notes are mainly of Indian interest. Advertising in them very seldom yields results. The Director General of Commercial Intelligence will be able to render better assistance than the Anglo-Indian or Indian commercial papers.

Manganese is the most important export mineral. At one time, America and Germany had a monopoly of the trade; but since the Harriman group has started operations in Russia, the demand from America has gone down. Germany, England, Belgium, France, and Italy now buy the Indian output. Japan is also a fair buyer, but sellers prefer to deal with Europeans or Americans.

During 1925, 839,701 tons of manganese was raised, against 803,000 tons in 1924. The increased output resulted in a fall in prices. In 1925, the average c.i.f. price was 21s. 3d. per unit; in 1924, it was 22s. 9d. The arrangement which an American group has made with the Russian Government has already affected the Indian trade. I was discussing the matter with a mine owner the other day. He said that the American group will find it no easy matter to mine in the Caucasus, and that the Soviet Government could not be relied upon to fulfill its agreement. He thinks that in the very near future American buyers will appear in the Indian markets, more largely than before, and then prices will soar to figures never before realized.

The actual quantity of manganese ore exported from India fell from 766,449 tons in 1924 to 731,881 tons in 1925. The three principal iron works in India, the Tata Iron & Steel Co., the Indian Iron & Steel Co., and the Bengal Iron & Steel Co., consume a large quantity of manganese ore, for they manufacture ferromanganese and also use it in the blast-furnace charge in the manufacture of pig iron. Of the quantity exported, the United States purchased 98,094 tons in 1924 but only 49,164 tons in 1925. Germany increased her purchases from 7,399 tons in 1924 to 30,258 tons in 1925.

An Indo-British combine has recently been formed, with the co-operation of the Central Provinces Manganese Co., for manufacturing ferromanganese on a large scale in India, thus providing the requirements of all the large steel works of this country at a low price. This will enable them to compete with American concerns. Several big mines have already changed hands. With my knowledge of the trade, I cannot help giving expression to my belief that the expectation of the combine will not be realized to any considerable extent.

McAllister Mine Closes

The McAllister mine, Three Forks, West Kootenay, B. C., which shipped 5,788 tons of ore to the Trail smelter during 1926, has been closed pending an increase in the price of silver, which is the only metal it produces in paying quantities.

London Letter

By W. A. Doman
Special Correspondent

Urquhart Issues Statement on Soviet Confiscation of Mines

London, Feb. 1—The most interesting feature to be recorded this week is the issue of a circular by Leslie Urquhart, chairman of the Russo-Asiatic Consolidated, Ltd. This deals with the position of the company in its relations with the Soviet Government, and states that the directors were categorically informed by the latter for the first time on Dec. 7 last that no confiscated properties would be returned to their rightful owners and that in no event would compensation be paid. The directors, therefore, had no other alternative but to stand by their claim for £56,000,000 lodged with the British Foreign Office over eight years ago at the request of the British Government. The object of the circular is to enlist the support of the many thousands of shareholders, who are requested to write to their representatives in Parliament asking them to induce the British Government to withdraw diplomatic recognition of the Soviet. The circular emphasizes the fact that the policy of conciliation adopted and pursued by the British authorities has been construed as weakness, and the opportunities given for trade have been utilized in fomenting revolutionary principles in every civilized country, and mainly in Great Britain and the British Empire. The present hostility in China is the result of propaganda designed to destroy British trade in the Far East. Activities of the Russian Communists are noticeable from Jugo-Slavia right across to China. The favorable balance, to Russia, of trade with Great Britain is not being spent here, but is utilized in the endeavor to disrupt the British Empire, notwithstanding the promises of the Soviet that such propaganda would cease. The circular further points out that in those countries that have followed the example of Great Britain and granted recognition, the Bolsheviks are stirring up trouble, whereas where diplomatic recognition is refused, endeavors at conciliation are made from the Russian side. Mr. Urquhart, therefore, expresses the opinion that we should be no worse off, and might in fact be courted, if our authorities would stiffen their backs, and do what he regards as the obvious. Mr. Urquhart speaks with authority, for he spent the best part of his life in Russia, both as mining and oil engineer. He knows the Russia language fluently, and the mentality of the Russian, and is acquainted with the leaders of the present movement. The existing situation is clearly a heart-breaking matter for him, after building up such a vast organization, which promised wealth to all interested.

At the Villemagne mines of the Russo-Asiatic Consolidated in Southern France, the old washing process is being improved, and the output is expected to be tripled in March. A hydro-

electric equipment has been installed, and the entire installation allows of a minimum horsepower of 770 during the dry season, and a maximum of 1,300 when the water supply is normal. A third electric station of 2,000 hp. is to be erected.

Lead mines have been opened near Harrogate, after being closed for about sixty years. It is stated that they were originally worked by the Romans. A shaft has been sunk and tunnels are being driven to mine the lead lodes.

The iron-ore discovery at the Tambura Pass, in Italy, near Lucca, shows that the lode extends for about half a mile, with an average width of 14 ft. The ore is a schistose hematite. At the Pass samples have given 41.9 per cent, and it is stated that with depth the content increases.

Harris Consolidated Being Financed in England

President L. G. Harris of the Harris Consolidated Mines, Ltd., operating in the Porcupine area of northern Ontario, has returned from England, where he succeeded in interesting a large number of British capitalists in the enterprise. The company is capitalized at $12,000,000 and owns 3,200 acres in the Porcupine area. Some of the properties included in the consolidation are provided with extensive plants and equipment, and diamond drilling and other developments have been carried on since the spring of last year. A large block of treasury shares has been underwritten in England.

Delaware Completes Purchase of Rex Consolidated

The Delaware Mines Corporation has made the final payment for all property owned by the Rex Consolidated Mining Co., near Wallace, Idaho. The organization of the Delaware corporation followed the "jumping" of all unpatented claims owned by the Rex. About that time the Rex company had filed a petition in bankruptcy, and last May all property of the company was sold at public sale to satisfy the claims of creditors. The Delaware corporation was the purchaser, paying $21,000 in round figures for the property, $10,000 being paid in cash. The final payment of $5,000, due Feb. 1, has now been made. Payments were made to L. C. Whicher, of New York, former president of the Rex company. The Rex mine was productive for several years, but the appearance of a large percentage of zinc made production unprofitable. The officers of the Delaware corporation are Matt Baumgartner, president; A. L. Hooper, secretary, and Frank J. Bailey, manager. All reside in Spokane.

Duthie Mines Building Flotation Plant

Duthie Mines has started work on the construction of a flotation concentrator at its Henderson mine, near Smithers, B. C. During 1926, besides high-grade, the company shipped 1,389 tons to the custom concentrator at Trail.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Mount Morgan Is Considering Steam-Shovel Mining—Mount Lyell Profits Low

Melbourne, Jan. 13—The Mount Morgan company has brought an American engineer, E. E. Barker, of the Utah Copper Co., to Australia to advise the Mount Morgan executive officers as to the feasibility of recovering the ore by open-cut mining. If Mr. Barker satisfies them in that respect the next step will be to decide that the subsequent treatment process can be operated profitably and that the outlay of new capital necessary for plant is justified. Installation of the reverberatory furnace is approaching completion, and in the meantime stocks of calcined concentrate and some purchased ore are being stacked. The services of an experienced American smelter foreman have been obtained.

The output of the Broken Hill field for 1926 is estimated at 1,288,000 tons, which is a slight increase over the 1925 figures. Owing to the lower average prices ruling, the value will probably show a reduction on the 1925 total of £6,335,000.

The year 1926 was the poorest year Bendigo has experienced in its history, the total yield aggregating only 15,642 oz., compared with 17,787 oz. in 1925. The Hercules and the New Red, White & Blue were the two largest producers. The Bendigo field has produced over 20,000,000 oz. of gold.

Speaking at the annual meeting of shareholders of the Mount Lyell Mining & Railway Co., George Swinburne had a great deal to say regarding the future prospects of the company. Active mine development is to be undertaken from the Mount Lyell Blocks shaft, recently brought into commission, and outside leases held by the company are to be geologically examined. It has been a matter of common belief for years that the mining operations of the company had not been particularly profitable, but this is the first occasion on which any specific official statement was made. Mr. Swinburne stated that the net profit from mining after providing for all expenses except taxation, but including no allowance for depletion of ore reserves, averaged about £26,000 per annum for the last five years. During that period the average capital invested has been approximately £800,000. To show how the company had been severely hit by increasing costs, he quoted the following figures comparing the years 1912 and 1926:

	1912 £ s. d.	1926 £ s. d.
Basic wage	0 9 0	0 13 0
Coal delivered at Regatta Point	1 7 3	2 10 0
Coke delivered at Regatta Point	1 10 3	3 3 5
Explosives delivered at Regatta Point:		
Blasting gelatin	2 14 0	3 4 3
Gelignite	2 1 6	2 13 6
Freight on copper, Regatta Point to Port Kembla	12 6	1 0 0
Refinery toll charge	3 10 0	*9 1 0
Price of copper	75 11 7	*64 10 0

*Date of statement.

R. M. Murray, general manager, has strongly recommended to the directors the erection of an electrolytic refinery at Mount Lyell instead of sending the metal to Port Kembla, N. S. W. The company is favorably situated in this respect, having surplus power available from Lake Margaret hydro-electric plant. The cost of the plant will be about £75,000. Further utilization of the power resources is also being considered. The company has recently made important additions to the fertilizer works at Yarraville, Victoria, and Fremantle, W. A., and although competition in fertilizers has been keen, the directors are satisfied that no other manufacturers can sell at lower rates and still earn profits for shareholders. The caustic soda works erected at Yarraville in 1918 have continued to make satisfactory progress, and the sale and use of chlorine and chlorine products are steadily extending. The company has now purchased a site near Sydney with a view of erecting a plant similar to that at Yarraville.

Michigan College of Mines Changes Curriculum

Material changes in the curriculum of the Michigan College of Mines, at Houghton, have been made by the faculty and the board of control. The three-year course at the college has been requiring about 15 per cent more work than other engineering colleges have been demanding in four years. Accordingly, the amount of work necessary for a degree has been reduced to correspond with the amount required by other high-class engineering colleges. This will give the students more time to devote to recreation and athletics.

In addition to the degrees of engineer of mines and engineer of metallurgy, the college also will offer three new bachelor of science degrees—one in geology, one in chemistry, and one in general engineering. A graduate degree of master of science also will be offered to those students wishing to carry their work further. The graduate degree will fit in well with the research work planned at the college, in connection with which graduate students will have an opportunity to work on problems of great importance to the mining and smelting industries.

East Texas Iron Mines Investigated

Production of iron from the east Texas iron-ore deposits several years ago by the Texas Steel Co. failed, it is stated, because of the relatively small scale of operations and the high cost of coke from Alabama. Under the management of C. T. Heisig, of Beaumont, Tex., the deposits have been examined and rights-of-way, connecting all the deposits with a central point, obtained. According to the Society for the Development of Texas Natural Resources, a solution of the fuel problem may be found through experiments now being conducted on lignite, immense deposits of which occur at a relatively short distance from the iron-ore deposits.

De Golyer Elected President of A.I.M.E.

Annual Meeting of Institute Draws Large Attendance— Proposed to Increase Dues

IN REGISTRATION, in quality of program, and in actual attendance at the sessions, the 135th meeting of the American Institute of Mining and Metallurgical Engineers was a complete success. Almost 1,200 members and guests made their appearance at the Engineering Societies Building in New York, where the sessions were held from Feb. 14 to 17 inclusive. In the great variety of papers presented there was something to interest every one engaged in any of the numerous pursuits embraced within the scope of the Institute's activities. The social affairs, such as the smoker, the daily luncheons, and the banquet offered their usual opportunities for making and renewing acquaintanceship, to say nothing of the affairs arranged by the Auxiliary for the ladies who attended.

S. A. Taylor, the retiring president of the Institute, at the annual business meeting told briefly what had been accomplished. The outstanding point of his talk was that the Institute must have more money, and the idea was advanced by him that possibly the annual dues of members might well be increased from $15 to $20 a year. Two outstanding events during the year had been, he said, first the establishment and endowment of a gold medal to be awarded for "Achievement in Mining," this as a result of the generosity of W. L. Saunders, past president. The first award of this medal was to be made at this meeting to David W. Brunton, of Denver. The other event of note was the gift of the library of the late Horace V. Winchell to the Institute. It was through the generosity of the Anaconda Copper Mining Co. and Mrs. Winchell that the 10,000 volumes comprising Mr. Winchell's collection had been received.

The report of the secretary, Dr. H. Foster Bain, as well as the other official reports, were in the hands of those present, in printed form. Dr. Bain reported that the year just closed had been a prosperous and successful one.

The treasurer's report demonstrated the satisfactory financial condition. It was pointed out, however, that receipts and funds available were not sufficient to permit the Institute to extend itself over the full field that should be open to it, the occupation of which would greatly benefit the Institute as a whole and its members. As a partial remedy an increase in annual dues was suggested. These were now lower than any of those of the three other founder societies. Another partial remedy that in time would be effective was the effort proposed to be made to secure an endowment fund of $1,000,000, the income from which was to be available for extending the Institute's scope of activities.

A surplus of about $75,000 existed this year, but next year there would probably be a deficit of $11,000 unless this surplus was drawn on, it was shown.

The matter of increasing dues was again referred to when the special committee appointed at the January meeting made its report. Sidney J. Jennings spoke against the proposition that had been made to advance the dues first to $17.50 and then to $20, and said that the members of the Institute should show their capacity to pay $20 dues per year, the same as the other societies.

Election of Officers

The election of officers was announced at the annual business meeting. E. L. De Golyer was made director and president, and George Otis Smith and F. Julius Fohs, director and vice-president. Five other directors were elected, namely, Frank H. Crockard, J. O. Elton, Daniel C. Jackling, David Levinger, and Richard Peters, Jr.

The new president was then led to the platform. He delivered a short and pleasing address. Humorously he remarked that his election was not entirely unexpected to him, owing to the method that the Institute had of conducting its political business. He said that he would endeavor to see if money to balance the Institute's budget this coming year could not be raised without increasing dues. In closing he remarked that too many members put their membership on a commercial basis. "What were they getting out of it?" they asked.

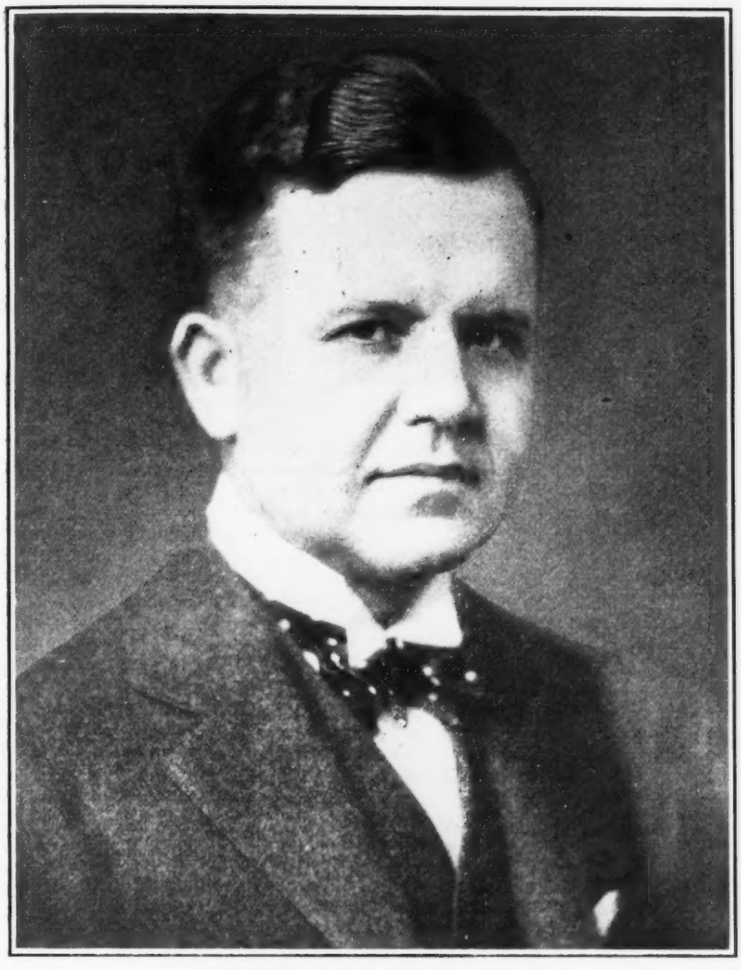
Another speaker said that the report of the special committee on increase of dues should be printed so that the sections might have the benefit of it. This speaker, C. T. Van Winkle, thought that there might be some opposition. The Utah Section, from which he came, he said, had instructed him to oppose an increase in dues. Likewise, Mr. Grant, of the San Francisco Section, said that a large per cent of the members of that section were mining engineers who were not in mining and who might quit if the dues were increased. The next speaker, Francis Thomson, of Idaho, speaking for his section, said that, whereas some of the members would be glad to pay the increase and more, nevertheless there would be opposition from the large majority, who did not appreciate the Institute as they ought.

Likewise it was reported that the Lehigh Valley Section, in Pennsylvania, included a great many who would quit if dues were increased. It was urged that it would be unwise to urge students below the senior class to join the Institute, if any increase in membership were sought.

R. Dawson Hall, of *Coal Age*, thought that it would be a good plan that all registering for the annual meeting should pay a registration fee, as is done in many other societies, and also that the members of the metropolitan district who were in a position to enjoy more privileges of the Institute than were those who were out of town should pay more dues than the latter.

The first of the technical sessions on mining and milling, called for 10 o'clock Monday morning, began with commendable promptness and with a good audience. Two papers on Alabama iron ores were presented: "Degree of Liberation of Minerals in the Alabama Low-grade Red Iron Ores After Grinding," by W. H. Coghill, and "Beneficiation of Alabama Siliceous Red Hematite," by Joseph T. Singewald, Jr. Mr. Coghill's paper was presented in abstract form by Oliver C. Ralston; the other by the author. D. A. Lyon, of the U. S. Bureau of Mines, participated in the discussion, explaining that the work that the Bureau had done in the beneficiation of these Southern iron ores was of a fundamental nature only, and intended to give the operating companies a basis on which further work of a commercial nature might be instituted. So far, however, the operators had done nothing in furthering the experiments on a commercial scale, though results had been in many respects promising. E. F. Burchard read an anonymous letter from a mine manager, discussing certain phases of the work. His correspondent did not feel that the Bottom Bench ore was so promising a subject for beneficiation as the siliceous ore from the northern section. In further discussion, D. A. Lyon stated that heat treatment previous to beneficiation had not been found particularly applicable to iron ores. He also spoke of the best heavy liquids to use for specific-gravity work. The Government was soon to issue a bulletin on the work that has been carried out at the Birmingham station, it having been in the hands of the printer for several months.

"Recent Developments in Classification" was the subject of a paper by A. M. Gaudin and W. L. Remick, which the last-named presented in brief form, it having been published in the February issue of *Mining and Metallurgy*. Mr. Remick considered that the most important classification problem was the desliming of flotation feed. In the paper mentioned, a new type of de-slimer, called the Hydrotator, was described, with comparative data on its performance. H. N. Spicer, of The Dorr Company, was not altogether satisfied with some of the data as relating to his company's product, and asked questions as to the type of classifier with which the hydrotator was compared and how it was run. The work, it seems, was done with a 2 ft. 3 in. Simplex Dorr classifier at Columbia University, and, as A. F. Taggart subsequently explained, was probably a student's test, and not carried out under the best conditions, which



E. L. DeGolyer

EVERETTE LEE DE GOLYER, the newly elected president of the American Institute of Mining and Metallurgical Engineers, is president of the Amerada Corporation and its subsidiary, the Amerada Petroleum Corporation. Six or seven years ago he became associated with the parent company as its vice-president and general manager, and recently succeeded to the presidency.

Mr. De Golyer is a young man, as his likeness shows, being now in his forty-first year. He was born at Greensburg, Kan., and gained his first experience with the U. S. Geological Survey and with that of Oklahoma. For nine years, beginning in 1906, he was with these organizations. During this period he obtained his A.B. degree from the University of Oklahoma. He became consulting geologist for the Mexican Eagle Oil Co., the Oil Fields of Mexico Co., and S. Pearson & Son, and went into general practice in the United States in 1914.

In addition to filling the presidency of the Amerada organization, Mr. De Golyer is also president of the Geophysical Research Corporation and vice-president and manager of the Rycade Oil Corporation.

Technical societies have received a large share of his attention, in particular the A.I.M.E. He is a fellow of the Geological Society of America and a member of the American Association of Petroleum Geologists and of the British Institution of Petroleum Technologists. He has written various papers regarding the Mexican oil fields, and the salt domes of the coastal region of the United States, as well as on the geology of Cuba.

accounted for the low efficiencies reported. The ball mill with which the classifier was connected in closed circuit in the Columbia experimental laboratories was not of a suitable size. Professor Taggart stated that a questionnaire that he had sent to several large operating mills in the country had brought replies from nine, showing that efficiencies of Dorr classifiers, making a 65-mesh separation varied from 48.2 to 73.6 per cent. He also discussed the efficiencies of bowl classifiers installed at Miami and Nipissing, which averaged somewhat higher.

Among the questions asked concerning the hydrotator was one regarding the advantage of returning slime from the top of the tank back to the intake. This, it was said, was done to increase the agitation at the bottom without the addition of an undue amount of clear make-up water. A query was also made as to whether difficulties had been experienced owing to waste material clogging the spigots of the rotating agitator. The reply was in the negative, except in some work on coal where large pieces had caused some trouble, though it was brought out that such material as wood chips and waste would of course not be conducive to the smooth operation of the device.

The next two papers on the program were "Underground Deep-hole Prospecting at the Eagle-Picher Mines," by W. F. Netzeband, and "Facts About Mine-timber Preservation," by George M. Hunt. Both of these were passed over without reading or discussion.

S. C. Ells then showed some interesting colored lantern slides illustrating his paper entitled "Potential Source of Asphalt-base Hydrocarbons in Northern Alberta." A vast deposit of asphaltic sand occurs at Fort McMurray, near railroad facilities, which will no doubt be developed in good time. The material has been proved excellent for paving purposes. Lack of time prevented discussion of this interesting paper, and also of the one by Samuel H. Dolbear on "Mine Finance," published in the February *Mining and Metallurgy*, the gist of which was given briefly by the author.

Salt Lake Meeting to Feature Milling

The Milling Methods Committee met for dinner at the Engineers' Club in the evening, which was presided over by Charles E. Locke in the absence of G. H. Clevenger in Canada. Following the dinner, there was some discussion of proper methods for the study of elutriation and the sizing of—200-mesh material, O. C. Ralston telling of some of the difficulties involved. J. V. N. Dorr offered a resolution asking the U. S. Bureau of Mines to make a study of the most desirable specifications of balls and rods for grinding media, and to secure from the large operating companies as much data relating to this subject as possible. The Salt Lake meeting of the Institute, to be held next September, is planned to be of special interest to millmen, and plans were made to secure as many papers on milling and concentration as possible. It is especially desired to have reports of the latest work on selective flotation, including, if possible, some description of the Utah Copper Co.'s experience with phospho-cresol and other reagents being tried as improvements on the widely used xanthate.

Four papers occupied the program at the Mining session on Monday afternoon, at which George A. Packard presided. The first of these, on "Acceleration Stresses in Wire Hoisting-ropes," was presented by the author, G. P. Boomsliter, of the Department of Mechanics of the Universtiy of West Virginia. Little had been said in the past, according to Professor Boomsliter, on the effect of the elasticity of the rope on the stresses due to acceleration. In hoisting with a motor-driven hoist, the elastic properties of the rope, it seemed, introduced in the rope considerable periodic acceleration stresses. Hoisting ropes in constant service often lasted only six months. The question might well be asked whether this short life were not due to excessive stress and this, in turn, to the neglect of the full effect of acceleration stresses. Although the use of

J. O. Elton

George Otis Smith

D. Levinger

F. J. Fohs

a safety factor of five seemed general practice, said the speaker, nevertheless calculations involving the theoretical acceleration stresses would reduce this factor in many cases to a little more than two. Since the endurance limit of steel was little more than half the ultimate strength, the greatest stress set up under normal conditions of hoisting was thus barely below the endurance limit in many cases.

How a simple empirical formula might be obtained for acceleration stress when rope weight was considered, this for use in designing a rope, was demonstrated by Professor Boomsliter. His conclusions indicated, he claimed, that a slight increase in size of rope should result in a very considerable increase in length of life and that a more rational design would make for a decided increase in ultimate economy.

Classifying Ground

Efforts made to classify rocks as to hardness and toughness were discussed by Emile E. Gyss and Henry G. Davis in a paper entitled "The Hardness and Toughness of Rocks." After citing attempts already made by others to determine a means of comparing hardness, the authors suggested that a more valuable classification could be obtained by comparing both drilling speeds and energy determinations per unit volume of drill hole cut. These data could be obtained, they said, from mine operators on rocks of different types and classes. In order that testing conditions might be as uniform as possible, they suggested the use of a machine drill of standard make, preferably a stoper operated vertically, and at a constant air pressure of 80 or 90 lb.; also a double-taper cross bit with a 90-deg. cutting edge and of certain diameters.

As for rock toughness, a table of relative toughness should indicate the relative amount and strength of explosive required for its most economical breaking. Besides this, the authors pointed out that, in any given rock, other factors would influence the powder consumption per unit of rock broken, such as the strength and character of the explosive; depth, size, number, and orientation of the holes; the desired size of the blasted product; and the number of free faces of rock blasted. Several tables of rock hardness and toughness were presented that had been obtained by using the Moh scratch test determinations of mineral hardness and the data of the U. S. Department of Agriculture. From the hardness data, it was claimed, a table could be compiled from which the drilling speed in any given rock under standard conditions could be closely estimated.

In the discussion that followed, George S. Rice said that the subject was well worthy of consideration and that he would like to see a subcommittee appointed to consider the classifying of ground as concerning drilling and a separate classification for blasting purposes. His opinion was that it was not wise to develop a factor that would take both drilling and blasting into consideration at the same time.

B. F. Tillson, of the New Jersey Zinc Co., said that it would be well to forget about hardness and to talk of "drillability." Previously, in speaking of "drillability," to use Mr. Tillson's word, Mr. Rice had referred to limestone as being quite variable in this respect. Mr. Tillson said that sometimes a higher drilling speed was developed in Barrie granite than in a certain limestone, although there was no comparison in hardness between the two. He said that hornblendic material was usually hard to drill, because of its resiliency; and that what we desired in rupturing different rocks was to know what force would rupture the rock beyond its strength—that is, the effective blasting force.

Arthur Notman told of some of the earliest experiments in studying ground at the Copper Queen, which were undertaken when that company became dissatisfied with the day's pay system. Some ground was found to be very hard to drill and other ground was such that you could put your finger in it. He said that it became a gamble as to who got the best of the contract, the miner or the company. Hence the company engineers tried to standardize conditions under which development work could be carried on. They went over 1,000 ft. of drifting on which records had been kept and also began to collect data as to current drifting. The factor that they used was footage per man-shift. Finally, drifting was begun on a bonus basis, a man being paid at the end of the work according to the ground that he had gone through. The conclusion was reached that in any individual property, after several years of experiment, the operator could standardize his own conditions. It would not be possible to work out factors, it seemed, that would be applicable to all ground.

George B. Holderer, of the Air Reduction Co., presented a paper on "Liquid Oxygen Explosive in Strip Coal Mining." Some interesting data were given showing that increased footage drilled during the period when L.O.X. was being used had been made necessary by faster shovel work. A comparison of the cost of labor for shooting showed a slightly higher labor charge during the L.O.X. period, although, actually, 62.9 per cent more shooting was done. Comparison of cost of explosives showed that the L.O.X. used in 1926 cost $46,525, against $56,395 for black powder in 1925. The work demonstrated, it was asserted, that L.O.X. was sutiable for the use in similar stripping operations, quarries, and open-pit mining in general.

George S. Rice, of the Bureau of Mines, in discussing the paper, said he was careful to avoid making any recommendations as to the use of L.O.X. underground. He believed, however, that it had a large field in special work.

The special committee of the Institute appointed to report on standardized maps for iron mines made its report at this meeting. The report was illustrated by a large number of slides showing the various sheets of the standardized maps. The committee consisted of Donald B. Gillies, Frank Blackwell, and Emerson D. McNeil.

Growing Problems of Ground Movement and Subsidence

Two sessions of the Committee on Ground Movement and Subsidence, under the chairmanship of H. G. Moulton, were marked by spirited discussion. On Wednesday morning Robert G. Bosworth, of Denver, Colo., presented a paper entitled "What Duty to Support the Surface Does the Sub-surface Owner Owe?" Mr. Bosworth discussed the legal phases of the situation.

In Colorado, particularly, the growing value of the land for agricultural purposes has emphasized the problem; and liability for damage to the surface caused by subsidence is an ever-present threat to operators of coal mines. Unfortunately, there has been much rather incoherent thinking on the part of the courts and lawyers, according to Mr. Bosworth, who declares that "there is no absolute duty of support owed by the mineral owner," despite numerous

expressions to the contrary by courts in Pennsylvania, Illinois, and Colorado. He maintains that surrounding circumstances in any particular case should govern and that no absolute rule can be laid down. The waiver of the right of surface support is a matter of contract, express or implied, according to most court decisions. Mr. Bosworth classified the types of mineral rights in respect to the reservation of the surface by the fee owner, and the reservation of the mineral rights by the owner.

Nevertheless, Mr. Bosworth advocates that in future leases some specific provision should be included, either requiring or waiving surface support. It is preferable to express clearly the intention of the parties at the time the transaction is entered into rather than to leave it for conjecture and future litigation.

In the afternoon W. T. Thom, Jr., discussed phases of subsidence as related to the extraction of petroleum. He cited examples in this country and in Mexico where the phenomenon had been definitely recognized. Mr. Moulton pointed out the fact that because of the lateral migration of oil within the sands the possibility of subsidence of surface areas adjacent to the actual lease arose. This complicates the problem. Likewise the tendency to recover a larger proportion of the oil, from sands that are known to be unconsolidated, may emphasize the results of subsidence.

E. L. De Golyer mentioned the methods of using air lifts and air "drives" to increase the recovery of petroleum and likewise brought up the question of the development of mining methods for extracting the oil. Mine workings, either above or below the oil sands, with a multiplicity of shallow wells or drains, will probably be used, and the possibility of subsidence will be increased. Mr. De Golyer did not feel that the oil operators could be aroused to the importance of the matter at the moment; but agreed, at the suggestion of Mr. Moulton, to bring the question to their attention.

Mr. Bosworth injected a remark regarding the difficulties encountered by operators of salt mines in Michigan because of the settling of the surface over mine workings.

George S. Rice presented a digest of the report presented last year by the Commission on Rock Bursts that surveyed the situation that has developed on the Rand, in South Africa, as greater depths have been reached. This report surveyed the situation in the Kolar gold fields in India; in Kalgoorlie, Australia; in the Ruhr coal fields, in Germany; in Nova Scotia; in the Michigan copper mines, and elsewhere.

In one recent year on the Rand 13,000 shocks due to ground movement were recorded by seismographs and the average for several years is almost as high. These, of course, included minor as well as major disturbances. In a seven-year period 526 rock bursts of consequence were reported, resulting in the killing of 193 workers and the injury of 498. Most of these were in stopes. An arbitrary definition of a rock burst has been decided upon as any "rupturing of the rock" not caused deliberately.

Two former commissions reported on the situation, and their conclusions are reviewed by the more recent investigators. The second report recommended increasing the size of pillars around shaft openings; and suggested the final removal of all "drive" and "slope" pillars with sand filling or "packs" to be provided in the stoped areas.

Further study has revealed the fact that sand filling is not effective; and the conclusion is reached that rock bursts *cannot be prevented.* Since they appear to be inevitable, the procedure recommended is to bend every energy to minimizing the consequences. The most effective measure is to choose mining methods that will keep workmen as much as possible out of the areas where serious bursts are likely to occur. The method used in the copper mines of Michigan of retreating from the mined areas so as to have the theater of active operations in comparative safety was commended highly. Other steps should be taken to avoid serious consequences, rather than to prevent the bursts themselves.

D. C. Jackling

Metal-Mine Ventilation

Coal men dominated the meeting on "Metal-Mine Ventilation." There was no reason for this, as the report of the Committee on Metal-Mine Ventilation in itself contained much to interest those engaged in metal mining. A. C. Callen presided. The report referred to, which was made by Daniel Harrington, declared that the ventilation of metal mines was becoming much more nearly a fundamental requirement than it was ten or even five years ago. The many reasons for this were based upon economy and efficiency rather than health or safety, although the latter were by no means excluded.

A Montana metal mine, said Mr. Harrington, which had installed fans and a general ventilating system, shut down the fans when work stopped for a time. Within a few weeks the underground timbers had become so fungus-covered that the fans were started again, and thereafter continued running whether the mine was worked or not. The fungus soon disappeared, and the cost of operating the fans was held to be far less than the loss that would result from timber decay.

A large iron-ore mine in Michigan, continued Mr. Harrington, had much difficulty in holding men in a slicing area, because of foul air under certain surface conditions due to direction of wind. This was remedied by installing a moderate-sized fan on the surface, with some doors, stoppings, and regulators underground, and the tonnage per man-shift was increased decidedly. Timber decay was likewise retarded by this procedure.

In the Southwest, a copper mine, having a high-sulphur ore, had great difficulty from poisonous fumes after blasting. In this mine the fan installation was as elaborate as in many of the most up-to-date coal mines. Because of these gases at blasting time, the time of blasting on each level was regulated by underground clocks.

Several non-coal mines, said Mr. Harrington, had encountered methane, so common in coal mines, and one of them now used an electric cap lamp in certain parts of the property. In other mines more or less frequent outflows of inert gases, such as nitrogen and CO_2, were at times encountered, sometimes with loss of life. At Cripple Creek some of the mines used surface fans to force air underground, allowing no outlet except that which it found through the strata, thus simultaneously forcing back into the strata the inert gases. There a study was being made as to the source of these gases.

Material progress had been made in the last ten years, particularly in the West, according to the speaker. Much of this ventilating was due to the need for removing dust, fumes, or gases, but, as stated before, a large amount of attention had been given the matter of securing greater efficiency in hot workings by methods of air circulation. The main fans were usually found on the surface, electrically driven and so placed that the air currents might be reversed if desired. Face ventilation was best accomplished in metal mines by small blowers and tubing, either of galvanized iron or canvas or other flexible material.

It had long been known, said Mr. Harrington, that one of the best preventives of miners' consumption was the use of adequate air currents. Up to the present this form of consumption has not been looked upon very seriously in the United States from an economic point of view. It was nevertheless recognized as the source of much sickness and of many deaths, especially in certain districts. During the last year, however, said the speaker, a situation had arisen in the metal mines of Ontario that should cause the metal-mining men of the United States to sit up and take notice. Miners' consumption, or, rather, silicosis, had been designated as compensable in Ontario in essentially the same manner as were accidents, and to date, the speaker said, there had been placed against the Ontario mines nearly one-quarter of a million dollars in silicosis awards. As a result most of the mines of Ontario had shown a decided activity in installing ventilating systems, water blasts, sprays, and other practices and methods for removing and keeping down dust.

B. O. Pickard presented a paper on

"Underground Air Conditions and Ventilation Methods at Tonopah, Nev." Another address of general interest was the description of the method of ventilating the new Liberty vehicular tunnels at Pittsburgh, by Louis F. Huber. This was followed by a discussion by Ole Singstad, chief engineer of the Holland tunnel.

During the last year, Mr. Harrington said, several notable contributions of literature to the ventilation of mines had been made, with data that were largely, if not wholly, applicable to metal mines.

At another session, devoted to physiology and presided over by Dr. R. R. Sayers, of the Bureau of Mines, an address on the physiological effects of mine dust was delivered by Dr. Edgar L. Collis, of the University of Wales, at Cardiff, and guest professor at Harvard.

Analyzing and Advertising the Education of the Mining Engineer

Mining schools from Boston to Berkeley, Calif., were represented at a well-attended session of the Committee on Engineering Education. Professors predominated, and as they are usually more articulate and perhaps more inclined to air their views than most engineers the discussion was spirited. W. E. Wickenden, director of investigation for the Society for the Promotion of Engineering Education, outlined some of the results of his inquiry into mining and other engineering schools and colleges. He summarized the tentative conclusions so far reached as follows:

(a) Engineering schools generally provide a complete system of education, somewhat in contrast to the highly specialized training for medicine, dentistry, and law.

(b) By-and-large, the present system is substantially sound. What is needed is to keep what is now offered, but to perfect and supplement. The particular requirement is to provide a medium for intermediate training: one that will not give a university degree but will equip men, with a much less expenditure of time and money, to take jobs requiring briefer but more intensive, more specialized, more technical training in a single branch of the industry or profession. Industry needs this type of man more than any other. There is at the same time room for development in post-graduate education.

(c) No attempt should be made to set out a standard model after which all engineering schools should be patterned. What is suitable in one locality and with one background and purpose will be entirely inappropriate elsewhere. Diversification is to be desired.

(d) Support, moral and financial, from the public at large and from industry is needed. There is little sentimental or emotional appeal in engineering, and it must be "sold" on the basis of economic advantage.

(e) The best results will be attained by long-range planning and co-operative effort on the part of the schools and universities themselves, the national engineering societies and industry. The three must work together.

The A.I.M.E. is about to make a survey regarding the matter of curriculum in "mineral technology," similar to surveys already made by the civil, mechanical, and electrical organizations. About 150 replies are anticipated, and these, with 800 already on record and a group on chemical engineering, will provide a source of data from which "a mandate from the professional body to the schools" will be prepared.

Dean Frederic L. Bishop of the University of Pittsburgh outlined the expanded plant of co-operative work with the Westinghouse company, whereby some members of the graduate faculty are recruited from the Westinghouse staff. He voiced incidentally the opinion that a degree of engineer should require something more than scholastic attainments. Mr. Wickenden seconded this idea and suggested that the founder societies might co-operate by "evaluating the credentials" of the candidate for a degree, which would be given weight by the university considering the conferring of a degree.

Dean Elmer A. Holbrook, of Pennsylvania State College, wanted to know how to interest the high-school boy in engineering education. He said that the courses that lured most boys were electrical engineering, commerce and finance, and medicine. This started the discussion of advertising and "selling."

Irving A. Palmer, professor at the Colorado School of Mines, has a field secretary whose duties involve visiting high schools to recruit desirable material. A statement that is perhaps surprising to many is that 40 per cent of the students are now studying in the petroleum course, and that about that proportion of the graduates of the institution in recent years have gravitated to the petroleum industry.

C. H. Fulton, president of the Missouri School of Mines, at Rolla, strongly advocates publicity for the mineral industry and has a small organization engaged in the work. He admits that something about the Rolla school generally creeps into the material that these press agents send out, but maintains that this is not the primary object.

Wrong Publicity for Mining

T. T. Read thought the mineral industry had had plenty of publicity but of the wrong kind. He painted the mental picture that the average man has of the mining engineer, and ventured that it was little wonder that few boys were particularly attracted.

Dr. William O. Hotchkiss, president of the Michigan College of Mines, among other things emphasized the view that a mining-engineering course is pretty good preparation for any kind of a career, and averred that he did not care particularly what sort of work his graduates entered after leaving school.

George C. Bateman, Secretary of the Ontario Mining Association, apropos of the results of publicity, told of the great interest aroused among the general public by getting news into the papers about mining activity. What the papers want is news that will interest readers; and if the university people will see that live news gets to the editors, they will get plenty of publicity.

A joint meeting of the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers was held Feb. 15 at 2 o'clock in the Engineering Societies Building, the subject of the meeting being "The Conservation of Mineral Supplies," Dr. George Otis Smith presiding. The question of appraisal and conservation of mineral supplies, and also of comprehensive statistical information concerning mineral supplies, not only in the United States but in the whole world, was discussed by Messrs. Allen, Hotchkiss, Taylor, Manning, Turner, Moore, Ellis, Spurr, and others. As an outcome of the meeting a resolution was passed to appoint a committee to consider in what way the campaign for the study of minerals from the standpoint of reserves and conservation could best be carried on. This committee, with Philip N. Moore as chairman, will submit recommendations to the governing boards of the two societies.

The Geology Session

An afternoon session of Wednesday was devoted exclusively to papers on geology. Dr. W. R. Crane presented an interesting paper on the "Drainage in the Red Ore Mines of the Birmingham District, Alabama," based on an intimate study of the geological conditions of the district. He states that the amount of water pumped from the mines averages about 1.43 times the amount of ore mined. The object of his study was to determine the possible source of the water and devise means for its diversion from the mines. He presented a mass of data regarding rainfall run-off, watersheds, drainage basins, folding and faulting of the rock formation, and a description of the iron-ore deposits. His conclusions indicate that much of the mine water encountered was due to its entrance through broken top rock as the result of mining operations, and some relief could be obtained by more careful mining methods and filling up old stopes.

"The Geology of Pioche, Nevada," was the subject of a paper by Adolph Knopf and L. G. Westgate. After discussing the aërial geology and giving a description of the formations from the Paleozoic, through the Cambrian to the Tertiary, he discussed the general features of the ore deposits, stating that the bonanza production came from fissure veins in lower Cambrian quartzite. The two largest mines, he said, in four years distributed nearly $5,000,000 in dividends. He gives a ray of hope that some of the thin, poorly mineralized fissure veins at or near the surface may become stronger when they extend down to the underlying quartzite. Discovery of the deeper orebodies will be difficult and will require application of the best geologic knowledge and a study of the faulting system.

"Magnesite Mining in California" was the subject of a paper by Leroy A. Palmer, in which he discussed briefly the general geology of the Coast Range deposits. He states that the orebodies average about 10 ft. in thickness and favors the conclusion that they were formed by percolating waters passing

through open fissures and depositing the magnesite within the fissure walls. Mining methods, grading of the ore, and burning and preparation of calcined material for the market were discussed and described in detail.

The "Relations of the Disseminated Copper Ores in Porphyry to Igneous Intrusives" was presented in a brief paper by W. H. Emmons. He outlined the history of disseminated copper ore in porphyry from the introduction and solidification of a magma, fracturing of igneous rocks due to stress; the metallization of the porphyry by ascending hot waters from deep sources; the exposing, errosion, and leaching of the metallized porphyry, and the deposit of secondary minerals. Citations and references to the various porphyry deposits in the United States were frequent and numerous, including such orebodies as Bingham, Ely, Miami, Ray, Clifton-Morenci, Burro Mountain, Bisbee and Cananea.

Clays of Southern California were described in a paper by Robert Linton in which were set forth details of a number of deposits and comments on their adaptability to commercial uses. "Manganese Ore Deposits of the Gold Coast, Africa," is the title of a paper prepared by A. E. Kitson. Besides describing a number of important deposits, considerable time was devoted to a discussion of the petrology of manganese-silicate-bearing rocks associated with the ore deposits from notes submitted by N. R. Junner. The paper was read by E. F. Burchard, of the U. S. Geological Survey, who is an authority on manganese deposits of the United States and the iron-ore resources of the world.

The American Museum of Natural History has a very complete collection of elements as they occur in nature, as well as those that have been produced by chemical and metallurgical methods. These were discussed by Dr. George F. Kunz, setting forth how they had been acquired by the museum and placed on exhibition for the benefit of the public. His special plea was for more interest in such matters. It is hoped that members who are in a position to do so may be able to augment this already splendid exhibit.

PETROLEUM PROGRAM AMBITIOUS

A very large percentage of the program was devoted to petroleum topics. The meetings of the petroleum division began on Tuesday afternoon and ran in two parallel sessions through Thursday. The scope of the program was wide enough to include economics, engineering research, refining, production engineering, engineering education as related to petroleum, and corrosion. To describe, even in brief, the proceedings of these sessions would require a separate issue.

The annual banquet was held on Wednesday evening at the Waldorf. Thomas Stearns, of Denver, was toastmaster.

VEHICULAR TUNNEL

The New York-New Jersey Vehicular Tunnel (Holland tunnel) under the Hudson River from New York City to Jersey City was one of the points of interest visited by engineers and a number of ladies. This double-tube tunnel is designed to handle 46,000 automobiles per day; is 100 ft. below the surface of the river; and is driven a large part of the way through river mud and silt. The big problem in relation to this tunnel is the matter of ventilation, which is provided by 6,000 hp. ventilating equipment with sufficient capacity to change the atmosphere in the tunnel once every minute and a half, using only about half of the installed power. The tunnels will be equipped with safety and traffic signals. Wrecking crews to take care of disabled motor cars are to be provided. It will be thoroughly lighted and efficiently policed at all times. The tunnel is rapidly nearing completion. and it is expected that the installation of the ventilating system will be concluded this summer and that this mile and three-quarter tunnel will be open to traffic late in 1927.

American Ceramic Society's Twenty-ninth Annual Meeting

The twenty-ninth annual meeting of the American Ceramic Society was held in Detroit, Mich., Feb. 14-18 inclusive. An elaborate program of technical papers, relating to various phases of the ceramic industry, and visits to various industrial plants in Detroit, fully occupied the five days. Office of the secretary of the society is 2525 North High St., Columbus, Ohio.

Nichols Elects Directors

At the annual meeting of stockholders of Nichols Copper Co. held Feb. 9, 1927, at the main office of the company, Laurel Hill, Long Island, New York, the following directors were elected: William H. Nichols, C. W. Nichols, E. R. Nichols, F. H. Nichols; James S. Douglas and Archibald Douglas, of the United Verde Extension Mining Co.; Fernand Pisart, of Société Generalé des Minerais, Brussels, Belgium; and Edgar Sengier, of Union Minière du Haut-Katanga, Brussels, Belgium.

American Chemical Society Meets at Richmond

The increasing importance of lime in industry has awakened the interest of scientific men of the country, and as a result a symposium on lime has been included in the program of the American Chemical Society for its spring meeting at Richmond, Va., April 11 to 16.

Three half-day sessions will be devoted to the technical problems involved in the production and use of this material. The fact that 115 industries use lime in one form or other and that lime touches most of the activities of modern life promises a large attendance and an active interest in the subjects discussed. Men prominent in those industries manufacturing and using lime, and chemists interested in investigational work, will participate in the presentation of papers and in the discussions.

Tri-State Branch Zinc Institute Elects Officers

At a meeting held at Picher, Okla. on Feb. 2, W. T. Landrum, manager of the Cortez-King Brand Mines Corporation; A. T. St. Clair, of the Federal Mining & Smelting Co.; D. C. McKee, of the Empire District Electric Co.; and E. E. Butcher, representing the associate members, were elected directors of the Tri-State branch of the American Zinc Institute, in the Joplin-Miami district. The new directors will meet at an early date and select officers for the organization for the ensuing year.

Eleventh Exposition of Chemical Industries

The Eleventh Annual Exposition of Chemical Industries will be held in Grand Central Palace, New York City, Sept. 26 to Oct. 1, 1927. Plans are progressing rapidly, and the indications are that many new and interesting features will be exhibited.

The value of such expositions has been evidenced by the record attendance in the past, thereby establishing the fact that the Allied Chemical Industries are of vital importance to the entire business world.

University of Illinois Offers Research Graduate Assistantships

To assist in engineering research, the University of Illinois maintains fourteen research graduate assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry. Additional information may be obtained by addressing the director, Engineering Experiment Station, University of Illinois, Urbana, Ill.

Missouri Proposes Merger of Mines and Labor Departments

Missouri mining men are aroused over a measure that has been introduced in the State Legislature which has for its purpose the merging of the State Mining Department with the Department of Labor and Industrial Inspection. The bill, which was introduced by Senator Brunk, of Aurora, has for its purpose more economical operation of governmental departments; but mining men feel that its practical result would be to make possible the naming and direction of mine inspectors by men who might and probably would not know anything about mining. This, they feel, would be highly derogatory to the efficient operation of the important work of mine inspection. Mine safety is too serious a problem to be in the hands of a novice.

Recent Technical Publications

Reviews, Abstracts, and References

Metal-Mine Ventilation

Ventilation of Mines. By Walter S. Weeks. McGraw-Hill Book Co., New York City. Price $3.

A Review by D. HARRINGTON

Professor Weeks' book places before the public a synopsis of much of the data published by investigators in recent years in the domain of mine ventilation and particularly in ventilation of metal mines. In fact, the text is applicable so largely to metal mines, and so little specifically to coal-mine ventilation, that the title might well be changed to one such as "An Outline of the Physics and Mechanics of Ventilation of Metal Mines."

A distinct service is performed in bringing attention to the utility of various kinds of up-to-date instruments and equipment in connection with mine ventilation, such instruments and equipment as the psychrometer, the kata thermometer, pitot tube, inhalator, konimeter, carbon monoxide detector, methane indicator, various kinds of fans and tubing, flame safety lamps, electric cap lamps, compressed air jets and blowers, and like devices. However, it is unfortunate that more space was not given the methods of use and application of these instruments and equipment to actual operating conditions, pointing out the weaknesses, dangers, and deficiencies as well as the advantages of attempting to utilize these appliances in the ventilation of mines under actual operating conditions.

Most of the data as to "Air Measurements," "Flow of Air in Ducts," "Natural Ventilation," and "Mechanical Ventilation," although of undoubted value to manufacturers of fans, to college professors, and to others interested in the mechanics or mathematics of ventilation, will be of doubtful utility to the mine officials upon whom devolves the actual responsibility of ventilating the mines. The data as given are not sufficiently detailed and are interspersed with far too much mathematics to be usable by the fire boss, shift boss, foreman, or even the mine superintendent.

The chapter on "Physiological Considerations" gives up-to-date data as to effects of gases, dusts, and temperatures in underground air, the data being applicable chiefly to metal mines. It would have been desirable to have given some statistical information as to illnesses or inefficiencies brought about by dust, gases, or temperatures, to indicate *why* it is felt necessary to devote considerable space and attention to their discussion; especially is this true to the matter of dust in mines.

The discussions in the chapters entitled "The Ventilation System" and "Auxiliary Ventilation" are the type of information from which the mine operating official gets aid, since the mine superintendent, foreman, shift boss, or fire boss seldom knows much if anything of mathematics, and what he wants is direct simple statements of fact devoid of mathematical data or equations, or of references to other publications to which he does not have access or the necessary time or ability to read understandingly.

This book is of a new type as to ventilation and will be of decided value, particularly to college professors and to manufacturers of ventilating instruments and equipment. Metal-mining engineers can obtain much information of value from the book, particularly if they also read the references which are given so plentifully. The work is written from the viewpoint of the academician and will be of decided value to others engaged in ventilation work of an academic nature; it mentions or barely touches upon many features of interest to the operating man, and will probably incite his interest toward further study of essential details, and it is to be hoped that reading the book may spur some one with the operating viewpoint to "get busy" in the writing of another book elaborating on the points to which this book draws attention.

Sullivan Mine and Mill—Papers descriptive of the equipment and operation of the Sullivan mine and mill, and the progress made in the last three years, are included in the *Bulletin* of the Canadian Institute of Mining and Metallurgy for December (Drummond Building, Montreal; price $1). M. M. O'Brien and H. R. Banks are the authors. At present, ore is being mined at the rate of 1,100,000 tons a year and extracted through two adits; it yields about 100,000 tons of lead, 55,000 tons of zinc, and 4,000,000 oz. of silver. In the mill, the ore is ground by 8- and 10-ft. Hardinge mills; and by selective flotation, lead, zinc, and iron concentrates are made.

New Patents

Filter—No. 1,612,873. Jan. 4, 1927. Wilhelm Mauss, Durban, Natal, South Africa. Design for a rotary drum filter, the filter cloth being conducted away from the main large drum to a smaller cylinder where the filter cake is scraped off.

Rock Drilling Equipment

No. 1,613,139. Jan. 4, 1927. A. H. Skaer, Denver, assignor to The Denver Rock Drill Manufacturing Co., Denver. A drill-steel retainer.

No. 1,614,216. Jan. 11, 1927. H. H. Swartz, Bell, Pa. Method of supporting a rock drill.

No. 1,614,969. Jan. 18, 1927. F. W. Rudlin, Phillipsburg, N. J., assignor to Ingersoll-Rand Co., Jersey City, N. J. A distributing valve for rock drills.

Pot Dumper—No. 1,613,153. Jan. 4, 1927. C. P. Astrom, East Orange, N. J., assignor to M. H. Treadwell Co. Device for dumping pots or cars mounted on trucks for rail transportation.

Titanium—No. 1,613,234. Jan. 4, 1927. P. A. Mackay, London, England, assignor to National Metal and Chemical Bank, Ltd., London. Damp powdered titaniferous ore is treated with oleum, as a step in the production of titanium oxide.

Alunite—No. 1,613,238. Jan. 4, 1927. H. H. Meyers, Pittsburgh, assignor to Armour Fertilizer Works, Chicago. About 500 parts alunite, 200 parts limestone, and 25 to 50 parts carbon are mixed and treated, without melting, in a rotary kiln at a temperature of 1,100 to 1,600 deg. C. The potash is thereby volatilized and collected as potassium sulphate in a Cottrell treater; the lime combines with the alumina and silica of the alunite to form a calcium-aluminate cement.

Thawing Ground—No. 1,614,013. Jan. 11, 1927. F. S. Mulock, San Gabriel, Calif., assignor to United States Smelting, Refining & Mining Co., Portland, Me. A method of thawing ground consisting in delivering water to the ground to be thawed, at a point below the surface, and periodically and alternately reducing and increasing the rate of the flow of the water.

Flotation Agent—No. 1,614,089. Jan. 11, 1927. J. L. Stevens, Hayden, Ariz. The use of a normal sulphocyanide of an organic compound as a flotation reagent.

Metal Extraction—No. 1,614,149. Jan. 11, 1927. Aladar Pacz, East Cleveland, Ohio, assignor to General Electric Co. Rare metals of the sixth group, or compounds thereof, are separated from their ores by treatment with an alkali metal nitrite.

Copper Leaching—No. 1,614,668. Jan. 18, 1927. W. E. Greenawalt, Denver. Copper ore is ground with a relatively small amount of water, dilute acid then being added and the oversize removed by classification. The acid content of the oversize is then reduced and that material is then added to the new ore to be ground.

No. 1,614,669. Jan. 18, 1927. W. E. Greenawalt, Denver. Copper ore is separated into a high and low-grade concentrate. The low-grade product is roasted, leached with dilute acid to extract the copper, and the solution electrolyzed to deposit the copper and regenerate acid and ferric iron. The high-grade concentrate is fused, further concentrating the copper thereby, and this fused copper is used for reducing the ferric iron in the electrolyzed solution. Patent No. 1,614,670 is similar, except that the high-grade sulphide concentrate is used unroasted to reduce the ferric iron in the electrolyzed solution.

Agitator—No. 1,614,876. Jan. 18, 1927. T. M. Chance, Philadelphia. A cone-shaped agitator, with mechanical stirring means attached to a vertical axis, and with provision for a rising column of liquid under pressure, properly distributed.

Oil and Gas Engines—"The Internal Combustion Engine: Some Modern Types and Their Application to Mining," forms the subject of a comprehensive paper of 88 pages by W. A. Macleod in the *Bulletin* of the Institution of Mining and Metallurgy for November. Many charts and photographs are included. Copies of the paper are obtainable for 3s. 6d. each from the Office of the Institution, Cleveland House, 225, City Road, London, E. C. 1.

People You Should Know About

G. C. **Riddell** has gone to Central America. He will be away about two months.

John Wellington Finch, of Denver, Colo., is at Mina, Nev., on professional work.

Arthur W. Stevens, of Boise, Idaho, was in San Francisco recently en route to Los Angeles.

George H. Garrey has completed a geological examination of the properties of the Annandale Graphite Corporation, near Annandale, N. J.

Louis A. Wright, consulting enginer of San Mateo, Calif., who only recently returned from Europe, has left San Francisco on a professional trip to Italy.

L. B. Smith has resigned his position as manager of the Barry-Hollinger gold mine, in the Boston Creek area of northern Ontario, and will return to the United States.

A. L. Hennebeck and **S. M. Soupcoff,** engineers for the American Smelting & Refining Co., have returned to Salt Lake City from a trip to Nevada and California mines.

E. E. Barker, mining engineer, of the Utah Copper Co., has been engaged to advise on the proposed open-cut method of working the Mount Morgan mine in Queensland, Australia.

E. J. Watson, formerly with the Yukon Gold Co. at Kuala Lumpur, F.M.S., has returned to the United States and is now with the Bethlehem Shipbuilding Corporation in San Francisco.

S. Reg. Smith, representing the Hudson's Bay-Marland Oil Co., is making an inspection of the north area of the Turner Valley oil field, Alberta, where the company has extensive holdings.

Quincy A. Shaw, Jr., of Boston, Mass., who has been engaged in special work at Calumet & Hecla Consolidated properties in the Michigan copper district, has returned to the East.

George W. Snyder recently visited the Spruce Mountain district, Elko County, Nev., where interests represented by him have purchased the Spruce Consolidated Mining Co.'s property.

Joseph Errington, director of the McIntyre Porcupine Mines, Ltd., Ontario, Canada, is in San Francisco visiting **F. W. Bradley,** with whom he is associated in mining exploration near Sudbury.

H. Warington Smyth, Secretary for Mines and Industries for the Union of South Africa, left Pretoria for Capetown in December last and will remain there until the next parliamentary session is over.

John Daniell, of Los Angeles, mining engineer and geologist, has just returned from New Mexico, where he spent two weeks in making extended examinations of tin and manganese mines in Sierra and Catron counties.

Dr. Francis A. Thomson, dean of the school of mines at the University of Idaho, at Moscow, and State Geologist of Idaho, represented the Columbia Section of the A.I.M.E. at the annual meeting in New York, Feb. 14 to 17.

H. Mortimer Lamb is in Victoria, B. C., and will remain there during the present session of the Provincial Legislature, to watch in the interest of the Mining Association of British Columbia any new legislation affecting the mining industry that may be introduced.

Cyril W. Knight

Cyril W. Knight, chief geologist of the Nipissing, of Cobalt, is making an examination of the lead property recently acquired by the company in Black Township, Ontario.

John D. M'Lean, an officer of the Queensland Mines Department, has been appointed mining warden in New Guinea for twelve months, by the Australian Federal Government, in connection with the newly discovered gold field in that territory. Mr. M'Lean has had service in the administration of the mining laws on several Queensland mineral fields.

Arthur A. Zentner, research and metallurgical engineer, has established his office at 74 New Montgomery St., San Francisco. Mr. Zentner has been with the Anaconda Copper Mining Co. for fifteen years. He was at Anaconda, Great Falls and Helena, Mont., and for the past ten years was on the metallurgical staff of the electrolytic zinc plant at Great Falls.

Harris K. Masters, formerly with W. R. Grace & Co. as manager of that company's ores and metals department and later with the Wah Chang Trading Corporation as treasurer, director, and manager of its ores and metals business, has joined the Associated Metals & Minerals Corporation as manager of the corporation's metals, iron, and steel department. For the last two years Mr. Masters has been acting secretary of the New York Metal Exchange. He graduated as a mining engineer from the Columbia School of Mines and spent a number of years in the active practice of his profession in both mining and smelting in this country and in South America. Mr. Masters is a member of the Mining and Metallurgical Society of America and chairman of the New York Section; a member of the A.I.M.E., and an associate member of the American Iron and Steel Institute.

Obituary

Albert Ball, inventor of a diamond-core drill, died recently at Claremont, N. H. Mr. Ball was ninety-two years old. He was largely responsible for the development of the South African gold fields in the 80's, through the use of his drills.

Arthur J. Clark, who had formerly been interested in mining in Colorado, died in Beverly Hills, Calif., recently. Mr. Clark went from Colorado to California twenty years ago, and had developed important business interests there. He is survived by his widow and by a brother, Herbert Clark.

Everest A. Baylis, an employee at the concentrator of the Cananea Copper Co., was instantly killed recently when he was buried beneath a large quantity of ore in one of the receiving bins of the plant. The exact cause of the accident was not determined, as no one observed Mr. Baylis when he fell. His body was discovered some time later. Mr. Baylis was a veteran employee of the company and had lived in Cananea for many years. He was fifty-eight years old.

Dr. Charles Doolittle Walcott, secretary and executive head of the Smithsonian Institution, and one of the world's leading geologists, died in Washington, D. C., on Feb. 9. Dr. Walcott would have been seventy-seven years old on March 31. He was the son of Charles D. and Mary (Lane) Walcott, and was born at New York Mills, N. Y., on March 31, 1850. He got his academic education in the public schools of Utica, and at thirteen made a field excursion for geological research. Later he attracted the attention of James Hall, State Geologist of New York, who in 1876 took him as his assistant. In the next three years Walcott made geological surveys in New York, Ohio, Indiana and Canada. Then he joined the U. S. Geological Survey, and for nine years studied geological formations in the plateaus of Utah, the Colorado canyons, the mining regions of Nevada, the puzzling "Taconic question" in New England, and the Cambrian rocks in general. In 1888 he took charge of invertebrate palæontology, in 1891 became chief palæontologist, and in 1893 was placed in charge of both geology and palæontology. In 1897 he became acting assistant secretary of the Smithsonian Institution, in general charge. Dr. Walcott had been president of the Washington Academy of Sciences and was associated with many other societies in this country and abroad. He received gold medals from learned societies in England, France and America, and the honorary degrees of LL.D. from Hamilton, Chicago, Johns Hopkins, Pennsylvania, Yale, St. Andrews and Pittsburgh, Sc.D from Cambridge and Harvard and Ph.D. from the Royal Fredericks University of Christiania. He was the author of more than a dozen volumes on geological, palæontological and allied topics, as well as many official reports and pamphlets. Dr. Walcott married in 1888 Miss Helena B. Stevens, of Rochester, N. Y., who died in 1911, and in 1914 he married Miss Mary Morris Vaux, of Bryn Mawr, Pa.

Market and Financial News

Aluminum Company Floats $60,000,000 Bonds

Net Income for Last Three Years $18,000,000—Stock-Market Valuation, $200,000,000—Construction Program in Hand

A SYNDICATE of bankers in New York and Pittsburgh is offering $60,000,000 of 5 per cent sinking-fund debenture gold bonds of the Aluminum Company of America. The issue is available to the public at par to yield 5 per cent.

The bonds are subject to redemption as a whole or in part on any interest date upon sixty days' notice or for sinking-fund purposes upon four weeks' notice, at 105 and accrued interest if redeemed on or before March 1, 1937, or at 103 and accrued interest if redeemed after March 1, 1937.

Arthur V. Davis, president of the company, states that the company, which was established in 1888, mines bauxite, smelts aluminum therefrom and fabricates it. The primary business of the company is the smelting of aluminum from its ore at its smelters at Niagara Falls and Massena, N. Y.; Alcoa, Tenn.; Badin, N. C.; Shawinigan Falls and Arvida, Province of Quebec; and in Norway. Aluminum is smelted by an electric process and for this purpose the company is at present utilizing more than 500,000 hp. The hydro-electric plants for the development of this electric power are either owned by the company or the electric power therefrom is obtained under long-time leases at such rates as make these leases very valuable. The company has several undeveloped water powers which when developed will considerably more than double the company's supply of electric power.

The company also carries on an extensive fabricating business, producing aluminum sheet, rod, wire, tubes, castings, and other similar forms. Its mills for this purpose are located at Alcoa, Tenn.; New Kensington, Pa.; Edgewater and Garwood, N. J.; Buffalo, Niagara Falls and Massena, N. Y.; Cleveland, Ohio; Detroit, Mich.; Fairfield, Conn.; Toronto, Ontario and Shawinigan Falls, Province of Quebec. The company owns its own bauxite mines in Arkansas, South America, and several European countries and has its plant for the preliminary refining of bauxite at East St. Louis, Ill.

The proceeds of the new bonds will be applied partly toward the redemption of the company's entire outstanding funded debt, except the $1,000,000 par value 6 per cent gold notes due 1934 on its subsidiary, the Franklin Fluorspar Co., which are not subject to redemption at the present time. The company will also pay a bank indebtedness of $5,500,000 which has been incurred in the last four months in connection with its building program.

The remaining proceeds of this issue are to be used for the corporate purposes of the company, including a large building program in which the company is engaged and which it is anticipated will be completed by the end of 1928. This program consists principally of the building of dams and hydro-electric plants at Santeetlah and at Badin, N. C., and an aluminum smelting plant, ore plant and town at Arvida, Province of Quebec.

For the ten years ended Dec. 31, 1926, the net income of the company, after taxes and depreciation available for interest, has averaged over $12,000,000 per annum and for the last three years such net income has been, respectively: 1924, $13,425,266.69; 1925, $22,891,505.40; and 1926, $19,747,068.85.

The present quoted prices of the preferred stock and the common capital stock of Aluminum Company of America indicate a value exceeding $250,000,000. Since its inception the policy of the company has been to put back into the business a large portion of the earnings. For the last five years the amount put back has averaged more than 75 per cent of the earnings before dividends. The issue and sale of the bonds are subject to the approval of the stockholders of the company and will be submitted to the stockholders at a special meeting to be held April 11, 1927.

Texas Gulf Sulphur Had Best Year in 1926

Earnings of the Texas Gulf Sulphur Co. in 1926 were the best in the history of the company, profit-and-loss surplus amounting to $9,383,813, compared with $5,689,241 in the previous year.

The extraordinary gain in Texas Gulf's profits from $5,689,241 in 1925 to $9,383,813 in 1926, an increase of $3,700,000, or about 65 per cent, is due largely to the higher price obtained for sulphur during the year, owing to the fact that old long-term contracts made at low prices expired and have been renewed at the present levels. Sulphur is now priced at $18 a ton at the mine and $22 a ton at seaboard, the differential being due to freight. The export price of sulphur is now around $23 a ton, but varies according to destination.

In addition, a number of important economies were put into effect, chief among which was the installation of gas as fuel instead of the oil which had been used.

In the seven complete years of operation, net income has aggregated $33,753,661, dividends paid have totaled more than $25,000,000 and the current market price of 53 for the new capital stock places a market value of $134,620,000 on the property.

Income account for year ended Dec. 31, 1926, is shown in the following table:

Gross income	$18,152,030.77
Total cost of sales and other expenses, including federal taxes accrued	8,768,217.16
Profit-and-loss surplus for period	$ 9,383,813.61
Add surplus at beginning of period	7,240,275.58
	$16,624,089.19
Deduct dividends 18, 19, 20 and 21	7,620,000.00
Total surplus carried to balance sheet	$ 9,004,089.19

Buyers' Strike Among Copper Consumers in England

Commenting on the formation of Copper Exporters, Inc., which it calls the outstanding feature of 1926, Lewis Lazarus & Sons, of London, says:

"This corporation (which for easy reference we propose to call the association) is in effect a central selling agency for the marketing of copper in countries other than the United States of America at a uniform price, thereby eliminating competition in the export markets of the world. Such an association would not be allowed by law to function in the United States for domestic business, and thus we have the position that while the market for export is controlled, the United States remains the only free market in which producers can sell.

"The possibility that such an association might be formed was first mooted in February, 1926, and, until it started operations on Friday, Oct. 15, the feeling that such a powerful organization would be able to control prices, coupled with the idea which was widely disseminated that the intention was to stabilize prices in the neighborhood of 15c., had the effect of preventing any serious reaction in values. The first three months' working have hardly been auspicious. On Oct. 15 the price of electrolytic for this country was fixed at £67 and the price to other countries was on a similar basis. On Nov. 5 the price was reduced to £66 5s, on Nov. 22 to £65 7s 6d, on Nov. 30 to £64 12s 6d, on Dec. 29 to £64.

"The reasons for the initial failure of the association to maintain or stabilize prices are not far to seek. The projected association was credited with powers which in fact it has been found not to possess. The artificial stimulus which this belief gave to the market and which maintained values during the first nine months of the year has been removed, and the law of supply and demand, which is always bound in the long run to make itself felt, is now governing the course of values. There are ample supplies of copper to meet all requirements, and as it is no longer possible to compete in the export market, producers are

reduced to competing for orders in the American market. The consumer in America has not been slow to recognize the advantage which this gives him and is able to choose his own time to cover his requirements. The European consumer is in a different position and is protecting himself as far as possible by buying from independent sources which still have copper available. In a mild way, too, he has been indulging in a 'buyers' strike,' partly out of dislike for the association and partly as a protest against the policy which the association has adopted of charging to the foreign consumer a price higher than the price quoted to the American consumer. The policy of the association in discriminating between the domestic and the export market is surprising in view of the fact that it is the export market which needs to be encouraged."

Bolivian Tin Production Declined Slightly in 1926

G. A. Witts, of London, publishes the following table showing tin-ore exports from Bolivia during 1925 and 1926. The shipments, in long tons, were made to the following destinations:

	1926	1925
United Kingdom	28,026	32,615
United States	110	23
Germany (Hamburg)	1,158	31
Brlgium (Antwerp)	2,576	251
Feance (Marseilles)	241	60
Totals	32,111	32,980

Allowing for the fact that some 400 tons of ore found its way from the United Kingdom to Germany during 1926, it would appear that only 87 per cent of the Bolivian shipments will be smelted in the United Kingdom, compared with 99 per cent in 1925, says the accompanying letter. The main feature in the figures is the resumption of ore shipments to German smelters via. Antwerp and Hamburg. The additional number of smelters thus working in Europe will make for acceleration in tin production, a not unimportant feature, considering that tin stocks generally are still on a low level.

Another reflection is that German tin production in 1927 (the first full year of resumed activity) may conceivably reach 5,000 tons. This figure becomes of greater importance if the reports are correct that with new machinery German smelters will deal largely with low-grade ores, as in that case these smelters will be supplementary to English smelters rather than new competitors.

Moreover, though production in Bolivia may not be expanding, it is known, of course, that large quantities of low-grade tin ore exist, which hitherto could not be moved, in the absence of suitable smelting machinery. We are, therefore, inclined to look for some increase in ore shipments.

Acceleration of smelting in Europe and newly installed machinery in the Straits Settlements should make for a substantial increase in the available supply of tin this year, unless Chinese supplies further contract materially. Consumption in the United Kingdom will probably improve, but elsewhere the outlook seems less satisfactory, and we confess to some misgivings as to the industrial outlook in the United States. Hence the present price level is hardly conducive to bull operations, and though lower prices thus seem indicated, sharp fluctuations are likely in view of the dangerous nature of bear operations on the basis of present small stocks.

Statistical Notes

American Zinc, Lead & Smelting Co., owner of 70 per cent of the 9,295 shares of the capital stock of the Wisconsin Zinc Co., will receive a dividend payment of $7 per share declared by the latter company. For the last two years the property of the Wisconsin company has been operated by leasers, on a royalty basis. To facilitate the payment of this $7 dividend the 925,000 shares of stock were reduced to 9,250 shares, by exchange of 100 shares of old for one new, wiping out the balance-sheet deficit.

Chief Consolidated Mining Co., operating in the Tintic district in Utah, reports net earnings from operations in the year 1926 as being $602,133. The earnings in the last quarter, however, were not sufficient, in the judgment of the directors, to warrant payment of the dividend. Total shipments of ore and concentrate were 159,283 tons. The average assay values, together with the total metal content, are shown in the following table:

Gold, oz.	0.064	10,152
Silver, oz.	16.182	2,577,530
Lead in lead ores, per cent.	15.26	(lb.) 20,853,404
Copper in copper ores, per cent.	2.28	(lb.) 1,467,029
Lead in zinc-lead ores, per cent.	8.80	(lb.) 10,713,283
Zinc in zinc-lead ores, per cent.	12.05	(lb.) 14,674,965

New Jersey Zinc Co. for the quarter ending Dec. 31, 1926, reports income after expenses, taxes, maintenance, repairs, depreciation, and depletion amounting to $1,574,100. To this is added $500,000 as a dividend from the Tulsa Fuel & Manufacturing Co. The following table shows comparative results for the four quarters of 1926:

Net income:	
First quarter	$1,683,896.01
Second quarter	1,607,538.09
Third quarter	1,673,823.21
Fourth quarter	2,074,100.72
Net income for the year	$7,039,358.03

The Cardiff Mining & Milling Co. has declared a dividend of 10c. a share, or $50,000, payable Feb. 5 to stock of record Feb. 1. The Cardiff mine, situated in Big Cottonwood Canyon near Salt Lake City, Utah, has a total dividend record of $1,075,000.

American Brass Co., owned by Anaconda, set a new record of shipments of fabricated brass and copper products in 1926, on top of a steady procession of new records in preceding years. Last year, including rod and wire mill at Great Falls, Mont., shipments totaled approximately 800,000,000 lb., against 743,000,000 in 1925. Of great interest to the copper industry is the development of a copper steam radiator for heating buildings. It occupies one-third the space of a cast-iron radiator and weighs one-eighth as much.

Freeport Texas Co., of which Freeport Sulphur Co. is a subsidiary, for the year ended Nov. 30, 1926, reports a net profit of $1,809,040 after expenses and reserves for depreciation, taxes and other charges. This compares with $750,309 in the previous year.

Andes Copper Co., Anaconda's new South American subsidiary, has begun the operation of its smelter in a preliminary way, according to advices from Chile to the U. S. Department of Commerce. The gross production from the mines of the country during January was approximately equal to that of December. Exports for the year 1926 totaled 185,000 metric tons, an increase over the preceding year of 23,657 metric tons.

Butte Copper and Zinc Co. publishes the following figures of comparative earnings for the last two years:

Calendar Years	1926	1925
Proceeds of ore	(a) $265,923	$444,398
Other income	25,591	26,134
Total income	$291,514	$470,532
Expenses and taxes.	96,990	91,583
Net income	$194,524	$378,950

(a) After deducting $10,000 written off for depreciation of plant and equipment.

Patino Mines & Enterprises Consolidated, Inc., operating tin mines in Bolivia, has submitted to the New York Stock Exchange a report covering the first ten months of 1926. It shows net profit in United States currency of $3,583,982, after expenses, taxes, and reserves for depreciation and depletion. The income account for the ten months follows: Total income, $11,059,080; costs and other deductions, $5,354,573; balance, $5,704,507; profit from railroad operations, $192,024; total, $5,896,531; accrued interest, $160,807; Bolivian profits taxes, $463,838; depreciation and depletion reserves, $1,687,902; net profit, $3,583,982.

Gold output of mines on the Rand in January totaled 839,000 oz., against 836,000 in December and 840,000 in November.

Union Minière's position for the year just past is discussed in the *Economist* of London by a correspondent who seems well posted on the affairs of the company. He says: "There was a reduction in output of 10,000 tons of copper, say 11 per cent, during 1926; expenses, because of shortage of labor, must have increased, and owing to stabilization of the franc for foreign settlements, the exchange rate will prove a little more unfavorable than in the preceding year. It appears probable, in consequence of these matters, and the added consideration that the average price of copper over the year was £4 5s. per ton lower, the profits of the Union Minière may not exceed £450,000, compared with £700,000 in 1925 and £850,000 in 1924."

South Kalgurli Consolidated, Ltd., for the three months ended Dec. 31, 1926, milled 23,625 tons, with a yield of £46,318. Total working costs were £37,648, and the resulting surplus was £8,670. Ore reserves are reported, in blocked out and probable on Australian lode and elsewhere, as of Sept. 30, 1926, as 339,000 tons, ranging from 6½ to 14 dwt.

The Market Report

Another Active Week in Copper and Lead —Zinc Also Improves

Copper Generally Quoted at 13c. in the East—Lower London Prices on Copper, Lead and Zinc Today

New York, Feb. 16, 1927—Having bought heavily for about ten days, at gradually advancing prices from 12½ to 12.90c., delivered in the East, the appetites of copper consumers were apparently satiated today, and the sales dropped well below the 1,000-ton mark for the first day since the buying movement began. The total for the week is better than average, though not near equal to that of last week, when the market activity was at its height. Today, practically all sellers are at 13c., Valley, and at least one sale was made at that level; on the other hand, a few small lots were sacrificed for less. Though the f.o.b. refinery price is quotably unchanged from yesterday, and lower than on Monday, the market is really stronger, for none of the large producers now seem willing to shade 13c. In the Middle West, sales were good up till yesterday, mostly at 13@13⅛c. Much of the copper has been for prompt and March shipment, some of the leading sellers refusing to quote for shipment very far forward. Manufacturers report orders greatly stimulated from the January rate by the recent advances in price of the crude metal. The export association raised its price to 13⅜c. c.i.f., yesterday and reports a good week's business in all of the important consuming countries.

Dealers Try to Boost Lead

The attempt at a bull movement in lead seems to have originated in London; prices in that market advanced every day for a week, dealers having accumulated stocks for a rise, so it is said. Dealers on this side followed suit, as high as 7.60c. having been quoted in the New York market. The large producers, however, after a study of the situation, report consumers apparently even better supplied with metal than normally, following the reasonably active market of recent weeks, and stocks of lead in the hands of smelters have also increased. No justification was found, therefore, for the advance. The American Smelting & Refining Co. firmly stuck to its 7.40c., New York, price, and the dominant interests in the Middle West have done practically nothing except between 7.30 and 7.325c., only a slight advance from last week. However, these sellers have been flooded with business, many of the inquiries in such a market, of course, being for forward delivery. In general, sellers have not been willing to quote beyond March, but no great difficulty has been found by consumers in getting their near-by wants supplied, particularly today, after the break in the London market, which has tempered the demand here considerably. Producers, of course, would like to see higher lead prices, but only if they can be maintained; an advance followed by a drop back toward 7c. would not be welcome. Battery manufacturers continue conspicuous by their absence from the lists of buyers. Otherwise, the buying has been well distributed.

Zinc Stocks Increase

Zinc sales have been slightly better than last week, but continue considerably below normal. Prices, however, have been well maintained, on account of the firm ore market. High-grade is unchanged at 8½@8¾c. delivered. Stocks of all grades of zinc again increased in January, as the following statistics of the American Zinc Institute show:

	Tons of 2,000 Lb.
Stock, Jan. 1	21,887
Produced	56,898
Shipped	48,873
Stock, Jan. 31	29,912
Shipped from plant for export	2,989
Stored for customers	500
Number of retorts operating Jan. 31	88,908

Tin Market Dull

A little interest was exhibited in tin yesterday, at the lower prices, but the market has otherwise been quiet all week, at firm prices around 69¼c. for prompt Straits. May deliveries are about 3c. less.

Daily Prices of Metals

Feb.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	12 55	66.75	69.25	7.45	7.275–7.325	6.60@6.625
11	12 625	66.75	69.25	7.45	7.325	6.60@6 625
12	Holiday	.....	.....	....	.....	.....
14	12.75	66.50	69.25	7.45	7.325	6.60@6.70
15	12.70	65.75	68.625	7.425	7.325	6 65
16	12.70	66 25	69.00	7.40	7.30	6.65
Av.	12.665	66.400	69.075	7.435	7.315	6.635

Average prices for calendar week ending February 12, 1927, are: Copper, 12.435c.; 99 per cent tin, 66.775c.; Straits, 69.275c.; N. Y. lead, 7.435c.; St. L. lead, 7.278c.; zinc, 6.590c.; and silver, 58.075c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	54¼	54⅜	60½	308	295¾	27⅜	27⅞	29½	29 11/16
11	54⅜	54⅞	61	308¾	294¾	27½	28 1/16	30	30 3/16
14	54½	55¼	61¼	308¼	294⅜	27 13/16	28 5/16	30⅜	30 7/16
15	54½	55	61¼	304	293	27⅞	28⅜	30	30 3/16
16	54¼	54⅞	61⅜	305¼	295	27⅜	27¾	29 15/16	30⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4.84⅝	57⅞	26 11/16	84s11½d	14	4.84⅝	56½	26 3/16	84s11½d
11	4.84⅝	56⅝	26¼	84s11½d	15	4.84 9/16	56⅞	26 3/16	84s10¾d
12	Holiday		26 3/16	.....	16	4.84½	57	26½	84s10¼d
					Avg.		56.975		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Silver Weak and Lower

The silver market has shown further weakness during the last few days, declining to 56½c; but at this point better demand caused some improvement, London advancing $\frac{5}{16}$d, although this was not fully reflected in New York. According to London reports China has been a continual seller and the Indian bazaars have been on the buying side, but orders from the last-named source have not been apparent to any extent in the local market.

Mexican dollars (Old Mexican pesos): Feb. 10, 44c.; Feb. 11, 43¼c; Feb. 12, holiday; Feb. 14, 43c; Feb. 15, 43¼c; Feb. 16, 43⅜c.

Foreign Exchanges Steady

Closing cable quotations on the principal foreign exchanges on Tuesday, Feb. 15, showed little change from a week before: francs, 3.92⅝c.; lire, 4.2c.; and marks, 23.70c. Canadian dollars, $\frac{5}{32}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum — Domestic or imported, 98 or 99 per cent grades, 26c. per lb. London, 98 per cent, £105@£107 per long ton for domestic consumption.

Antimony—Per lb., duty paid, New York: Chinese brands, spot, 14½@14⅞c.; April prices about ⅛@¼c. less; Cookson's "C" grade, spot, 18c. Market slightly lower on Chinese grades, owing to somewhat freer offerings in China and lack of consuming interest here. Cookson's slightly firmer. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c.

Iridium—Per oz., $115@$120 for 98 @99 per cent sponge and powder.

Nickel — Per lb., ingot, 35c.; shot, 36c.: electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton, according to quantity.

Palladium—Per oz., $58@$62. Pure metal as a constituent of crude platinum, $55@$59 per oz. London, £11@£12, nominal.

Platinum — Official price quoted by the leading interest on miscellaneous orders for refined metal, $107 per oz. on 10th and 11th. $108 on 14th, 15th, and 16th. Open market cash sales of large lots, in New York, $101@$104. Pure metal as a constituent of crude platinum, $98@$100. Advance in official price not reflected in outside market, which remains quiet.

London, £22 per oz. for refined and £18½@£19½ for crude. Dull.

Quicksilver—Per 75-lb. flask, $102. Market firm but quiet. San Francisco wires $101, steady. London, £17½ for spot.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and **Zirconium** are unchanged from the issue of Feb. 5.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@40c. Chemical grades unchanged from Feb. 5 issue.

Tungsten Ore — Per unit of WO_3, N. Y.: Wolframite, $10.75@$11; Western scheelite, $11.25@$11.50. Market firm on small business.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Feb. 5 issue.

Zinc Blende Advanced—Lead Ore Unchanged

Joplin, Mo., Feb. 12, 1927

Blende

High		$45.40
Premium blende, basis 60 per cent zinc	$44.00@	45.00
Prime Western, basis 60 per cent zinc		43.00
Fines and slimes, basis 60 per cent zinc	42.00@	39.00
Average settling price, all zinc		42.33

Galena

High	$95.80
Basis 80 per cent lead	90.00
Average settling price, all lead	94.16

Shipments for the week: Blende, 8,582; lead, 1,871 tons. Value, all ores the week, $538,050.

A more or less united decision among buyers to hold the Prime Western basis price to a level of $42 per ton was broken by two companies last week and the preceding week, with purchases of a few hundred tons, and this week one company bought 2,000 tons on Tuesday on a $44 basis. The ore bought this week is a very high Prime Western grade, and was a good buy, even if it did disturb the equilibrium of other buyers. The others would not meet this price today, but did advance the market $1 per ton.

The weakest feature of the market was the increased tonnage of metal in stock at the smelters, as reported by the Zinc Institute. There are now idle seventy or seventy-five mills, reputedly closed because concentrate prices are below the producing price cost, the latest estimate of which was $45.26 per ton. Production is lowered to approximately 12,000 tons per week. This also results in lowering the production of lead to about one-half what it was a year ago. About 40 per cent of the zinc and lead being shipped is from mines owned by the smelting companies.

Platteville, Wis., Feb. 12, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$44.75
Lead Ore	
Lead, basis 80 per cent lead	$95.00

Shipments for the week: Blende, 1,124 tons; lead, 40 tons. Shipments for the year; Blende, 8,411; lead, 220 tons. Shipments for the week to separating plants, 2,365 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fullers Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Feb. 5 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3⅞c. per lb. Quiet.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Feb. 5 issue.

Ferro-Alloys

Ferromanganese—Domestic and foreign, 78@82 per cent, $100 per long ton, furnace or duty paid, for delivery during first half of 1927. Spiegeleisen, 19@21 per cent, $36@$37, f.o.b. furnace; 16@19 per cent, $34@$35.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Feb. 5 issue.

Metal Products

Rolled Copper—Sheets, 21½c.; wire, 14½c., f.o.b. mill.

Lead Sheets—Full rolled, 11c. per lb.; clipped, 11¼c.

Nickel Silver—28½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 18⅞c. per lb.; rods, 15⅝c.

Zinc Sheets—11c. per lb., f.o.b. mill.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the Feb. 5 issue.

Steel Wire and Nails Lower—Coke and Pig Iron Unchanged

Pittsburgh, Feb. 15, 1927

The various price declines that have occurred of late have not disturbed the currents in the steel trade, as buying depends upon actual requirements and buyers have neither stocks to liquidate nor contracts on which to suspend shipments. The volume of trade has been increasing seasonally, slight improvement being noted from week to week. For three successive years the peak of steel production has occurred in March, but whether next month will be the peak month of the year remains to be seen.

Widespread shading in wire products has crystallized into an open reduction of $2 a ton by the various producers, making plain wire 2.40c. and nails $2.55, Pittsburgh. In some sections of the South irregularities remain.

Pig Iron—The Valley pig-iron market remains quiet, with prices unchanged at $19 for bessemer, $18 for basic, and $18.50 for foundry. On large-lot inquiries the basic and foundry prices might be shaded.

Connellsville Coke—The spot market is firmer, on account of light offerings, but prices are not quotably changed. Furnace, $3.25; foundry, $4.25@$4.75.

Mining Stocks—Week Ended February 12, 1927

Stock	Exch.	High	Low	Last	Last	Div.
COPPER						
Anaconda	New York	46⅜	45	46⅛	Ja. 15, Fe. 21	Q 0.75
Arcadian Consol.	Boston	*55	*55	*55		
Ariz. Com'l	Boston	9	8	8⅛	Ja. 7, Ja. 28	0.50
Calaveras	N. Y. Curb			1⅛		
Calumet & Arizona	New York	68⅛	66⅛	67⅛	De. 3, De. 20	Q 1.50
Calumet & Hecla	Boston	15⅛	15	15⅛	Fe.28, Ma.15	Q 0.50
Cerro de Pasco	New York	61⅞	60⅛	61⅛	Ja.13,Fe 1, Q	1.00
Chile Copper	New York	35¼	34⅛	35	Ma.4,Apr.1, Q	0.62½
Chino	New York	22⅛	22⅛	22⅛		
Con. Coppermines	N. Y. Curb	2⅛	2⅛	2⅛		
Copper Range	Boston	13½	13	13⅛	May, 1926	1.00
Crystal Copper	Boston Curb	*29	*27	*27		
East Butte	Boston	2⅛	2	2⅛	Dec., 1919	0.50
First National	Boston Curb			*9	Feb., 1919	0.15
Franklin	Boston	*15	*5	*10		
Granby Consol.	New York	32⅛	31⅛	32⅛	May, 1919	1.25
Greene-Cananea	New York	32⅛	30¼	32⅛	Nov., 1920	0.50
Hancock	Boston			*75		
Howe Sound	New York	39⅛	38⅛	38⅛	De.31, Ja.15	Q 1.00
Inspiration Consl.	New York	23⅛	23⅛	23⅛	De.16, Ja.3, Q	0.50
Iron Cap	Boston Curb	2⅛	2	2		
Isle Royale	Boston	10⅛	10	10⅛	Fe.4, Fe.19	Q 0.50
Jerome Verde Dev	N. Y. Curb	*41	*41	*41		
Kennecott	New York	61⅛	60	61	Mar. 4 Apr. 1	Q 1.25
Lake Copper	Boston	*95	*90	*95	June, 1925	0.50
Magma Copper	New York	34⅞	29⅛	33⅛	Dec. 1, Ja. 15,	Q 0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	*50	*35	*35	Nov., 1917	1.00
Miami Copper	New York	15⅛	14⅛	15	Fe.1, Fe. 15	Q 0.37½
Mohawk	Boston	39⅛	37⅛	39⅛	Ja.29, Ma.1	Q 1.00
Mother Lode Con.	New York	4⅛	4	4	De.10, De.31	SA 0.37½
Nevada Consol.	New York	14⅞	13⅞	14⅛	De.15, De.31	Q 0.37½
New Cornelia	Boston	22⅛	22	22	Fe.4, Fe.21	Q 0.50
Noranda	N. Y. Curb	21⅛	20⅛	20⅛		
North Butte	Boston	2⅞	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*49	*49	*49	Se. 1, Se. 15	0.03
Old Dominion	Boston	13⅛	12⅛	13⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†125	†120		De.24, Ja.3	Q 1.50
Quincy	Boston	15⅞	15⅛	15⅛	Mar., 1926	1.00
Ray Consolidated	New York	14⅛	14⅛	14⅛	Ap.20, Ap.30	0.25
St. Mary's Min. Ld.	Boston	25	22⅛	22⅛	Fe.10 Ma.10	2.00
Seneca Copper	New York	3⅛	2⅞	3⅛		
Shannon	Boston	*31	*30	*30	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	5⅛	5	5⅛		
Superior & Boston	Boston	*26	*25	*26		
Tenn. C. & C.	New York	12⅛	11⅛	12⅛	Fe.28, Ma.15,	Q 0.25
United Verde Ex.	N. Y. Curb	24⅛	24⅛	24⅛	Ja. 6, Fe. 1	0.75
Utah Copper	New York	111	111	111	De.15, De.31	Q 1.50
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*51	*51	*51		
Walker Mining	Salt Lake	*98	*90	*90		
NICKEL-COPPER						
Internat. Nickel	New York	42⅛	40⅛	42	De.16, De.31,	Q 0.50
Internat. Nickel, pfd.	New York			106	Ja. 13, Fe. 1,	Q 1.50
LEAD						
Gladstone Mtn	Spokane	*28	*28	*28	Ja. 1927	0.005
National Lead	New York	171⅛	160	171⅛	De.10, De 31	Q 2.00
National Lead pfd.	New York	118	117⅛	117⅛	No.19, De.15	Q 1.75
St. Joseph Lead	New York	41	40⅛	40⅛	Jn.10, Jn.20,	QX 0.75
ZINC						
Am. Z. L. & S.	New York	10	9⅛	9⅛	May, 1917	1.00
Am. Z. L. & S, pfd.	New York	49⅛	47	48	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4	4	De.9, De.24	0.50
Butte & Superior	New York	11⅛	10⅜	10⅜	De.9, De.24	Q 0.50
Callahan Zn-Ld	New York	2	1⅛	2	Dec., 1920	0.50
Eagle-Picher	Cincinnati	28	26⅛	28	No.15, De.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati			100	De.31, Ja.15	Q 1.50
New Jersey Zn.	N. Y. Curb	187	185	187	Ja.20, Fe.10	Q 2.00
United Zinc	N. Y. Curb			55		
Yellow Pine	Los Angeles	*29	*26	*26	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	1⅞	1⅛	1⅛		
Argonaut	Toronto	*47½	*41	*41		
Barry-Hollinger	Toronto	*79	*65	*66		
Carson Hill	Boston			*20		
Consol. W. Dome L.	Toronto	*16¼	*14¼	*14¼		
Cresson Consol. G.	N. Y. Curb			2⅛	De.31, Ja.10	Q 0.10
Crown Reserve	Toronto	*10	*9	*9	Jan., 1917	0.05
Dome Mines	New York	9⅛	9⅛	9⅛	De.31, Ja.30,	Q 0.50
Golden Center	N. Y. Curb	1⅛	1⅛	1⅛		
Golden Cycle	Colo Springs	†1.77	†1.75		No.30, De.10	Q 0.04
Hollinger Consol.	Toronto	22.50	22.00	22.15	Fe.9, Fe.25	0.10
Homestake Mining	New York	60⅛	60⅛	60⅛	Fe.19, Fe.25	M 0.50
Kirkland Lake	Toronto	*92	*87	*90		
Lake Shore	Toronto	18.50	18.25	18 38	De.2, De.15	X 0.20
McIntyre-Porcupine	New York	26⅛	26⅛	26⅛	Fe.1, Ma.1	Q 0.25
Newray	Toronto			*30⅛		
Night Hawk Pen.	Toronto	*6	*5	*5		
Portland	Colo Springs	†*55	†*52⅛		Ja.6, Ja.15, '27	0.02
Rand Mines	New York			9⅛	Au.23-30 Am. Sh.	1.52
Teck-Hughes	Toronto	6.28	6 05	6.16	Ja.31, Fe. 1	0.05
Tom Reed	Los Angeles	*59½	*40	*40	Dec., 1926	0.02
Tough-Oakes	Toronto	*61	*55	*55½		
United Eastern	N. Y. Curb	*50	*50	*50	July, 1924	0.05
Vipond Cons.	Toronto	1.65	1.65	1.65	Apr.1 Apr.15	0.03
Wright-Hargreaves	Toronto	10.75	10.25	10.35	Ja15, Fe.1	QX 0.15
Yukon-Alaska Trust	N. Y. Curb			20		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh			13		
Con. Cortes	N. Y. Curb	*12	*10	*12		
Con. Virginia	San Francisco	*5⅛	*4⅛	*4⅛		
Continental Mines	N. Y. Curb	4	4	4		
Dolores Esperanza	N. Y. Curb			*45	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	De.17, Ja.4	Q 0.08
Tonopah Belmont	N. Y. Curb	2	1⅞	2	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*30	*25	*25	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3⅛	3	3⅛	Se.30, Oc.21	SA 0.07½
West End Consol.	N. Y. Curb	*12	*11	*12	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*40	June, 1918	0.02

Stock	Exch.	High	Low	Last	Last	Div.
SILVER						
Beaver Consol.	Toronto	*70⅛	*66	*68	May. 1926	0.03
Canadian Lorrain.	Toronto	*61½	*57	*58½		
Castle-Trethewey	Toronto	1.20	1.05	1.08		
Comagas	Toronto	4.25	3.95	4.15	May, 1924	0.12½
Keeley	Toronto	1.65	1.58	1.62	Fe.28, Ma.	X 0.12
Kerr Lake	N. Y. Curb	*86	*80	*86	Oc.1, Oc.15	SA 0.12½
La Rose	Toronto			*10	Apr., 1922	0.10⅛
Lorrain Trout Lake	Toronto			*40	July, 1925	0.05
McKinley-Dar.-Sav	Toronto	*14⅛	*13	*14	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.40	3.16	3.17	De.30, Ja.15	Q 0.12½
Nipissing	N. Y. Curb	10	9⅛	9⅛	De.31, Ja.20	Q 0.15
Temiskaming	Toronto			*7	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	4⅛	4⅛	4⅛	De.18, Ja.5,	QX 0.15
Bingham Mines	Boston	44⅛	43⅛	44⅛	De.30, Ja.5	Q 1.00
Cardiff M. & M.	Salt Lake	*45	*41	*45	Nov., 1924	0.10
Chief Consol.	Salt Lake	3.10	2.95	2.95	Oc.10, No.1	Q 0.10
Consti'n Mng. & Mill'g	Spokane	*25	*24	*25		
Erupcion	Boston Curb	*99	*99	*99	De.18, Ja.3,	Q 0.10
Federal M. & S.	New York	95	60	75		
Federal M. & S., pfd.	New York	83⅛	76	79⅛	No.24, De.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*7	*5	*6		
Hecla Mining	N. Y. Curb	13⅞	12⅞	13⅛	No.15, De.15	Q 0.50
Highland-Surprise	Spokane	*15	*14½	*14½		
Iron King Mining	Salt Lake	*37⅛	*29	*36⅛		
Keystone Mining	Salt Lake	*38	*35	*38	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15½	*15	*15		
Lucky Tiger-Com.	Kansas City	†7.50	†7.25		Dec. 20, 1926	0.12
Mammoth Mining	Salt Lake	2 60	2.60	2.60	De.17, De.23,	Q 0.25
Marsh Mines	Spokane	2.25	2.00	2.00		
Park Utah	New York	7⅛	7	7⅛	De.15, Ja 2	Q 0.15
Plutus Mining	Salt Lake	1.85	1.85	1.85	Ja.10, Ja.15	Q 0.10
San Rafael	San Francisco			*28		
Silver King Coal	Salt Lake	8.20	8.00	8.15	De. 16, Ja.3	0.25
Silversmith	Spokane	*34	*32⅛	*32⅛	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*42	*38	*40		
Sunshine M. Co.	Spokane	*45	*43	*44		
Tamarack-Custer	Spokane	*38	*36	*36	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.12½	11.00	11.00	De.11, Ja.3	0.30
Utah-Apex	Boston	6⅞	6⅛	6⅛	Oc.3, Oc.15	Q 0.25
IRON						
Bethlehem Steel	New York	46⅞	45⅛	45⅛	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	80	74	74	Ja.15, Ja.25	Q 1.00
Colorado Fuel & Iron	New York	59⅛	53⅛	58	May, 1921	0.75
Gt. North'n Iron Ore	New York	23	21⅛	22⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	41⅛	41⅛	41⅛	Fe.15, Ma.1	Q 0.62½
Mesabi Iron	N. Y. Curb			*95		
Replogle Steel	New York	12⅞	10⅛	11⅛		
Republic I. & S.	New York	63⅛	60⅛	63	Fe.15, Ma. 1	Q 1.0
Republic I. & S. pfd.	New York	102	100⅛	102	Ma.15, Ap.1	Q 1.75
Sloss-Sheffield S. & I.	New York	120⅛	127⅛	130	De.10, De.20	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	108	108	108	De.20, Ja.3	Q 1.75⅛
U. S. Steel	New York	158⅛	156⅛	157⅛	Fe.28, Ma.30	Q 1.75
U. S. Steel pfd	New York	130	129⅛	130	Ja.29, Fe.26,	Q 1.75
Virginia I. C. & C.	New York	44	43	44	Jan., 1924	1.500
Virginia I.C.&C.pfd	New York			60⅛	De.15, Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York			32⅛	Ja.26, Ja.29	1.45
So. Am. Gold & P.	N. Y. Curb			3⅛		
Alum. Co. of Amer.	N.Y. Curb	73	72⅛	73		
Alum. Co. of Amer pf.	N.Y. Curb	102⅜	102	102⅜	De.15, Ja.15	Q 0.50
Vanadium Corp.	New York	40	38⅛	39⅛	Fe.1, Fe.15,	Q 0.75
Patino M. & E.	N. Y. Curb			25	Nov. 5, 1926	5 sh.
ASBESTOS						
Asbestos Corp.	Montreal	23⅛	23	23⅛	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	86	85	85⅞	De.31, Ja.15,	Q 1.75
SULPHUR						
Freeport Texas	New York	44⅛	41	44	Ja.15, Fe.1	Q 0.50
Texas Gulf, new	New York	54⅛	52⅛	53⅛	De.1, De.15,	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	42⅛	41⅛	41⅛	Fe.18, Ma. 1,	Q 0.75
Amer. Metal pfd	New York			109⅛	Fe.19, Ma.1	Q 1.75
Amer. Sm. & Ref.	New York	143⅜	138⅛	142⅛	Ja.14, Fe.1,	Q 2.00
Amer. Sm.&Ref.pfd.	New York	121⅛	120⅛	121⅛	Fe.4, Ma.1,	Q 1.75
Consol. M. & S.	Montreal	2.49	2.45	2.48⅛	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb			13⅜		
Newmont Mining	N. Y. Curb	69	69	69	De.31, Ja.17,	0.60
U. S. Sm. R. & M.	New York	35⅛	35	35	Ja.6, Ja.15,	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	46⅛	46⅛	46⅛	Ja.6, Ja.15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED FEB. 3, 1927

Name	High	Low	Last	Last Div. Date	Amount
Aramayo Mines (25 frs.)	80/—	78/9	78/9	Feb. 1927	5 (c.)
British Platinum (£1)	3/3	2/9	3/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	14/3	13/9	14/1½	Feb. 1927	6 annas*
Bwana M'Kubwa (5s)	6/7½	6/3	6/4½		
Camp Bird (2s)	4/6	2/7½	2/9		
El Ore (£1)	5/—	4/7½	5/—	Nov. 1924	2½ p.c.*
Esperansa (10s)	—/4½	—/2	—/2		
Frontino & Bolivia (£1)	11/6	10/6	11/—	Jan. 1927	5 p.c.
Mexican Corpn. (£1)	10/6	8/6	10/6		
Mexico Mines of El Oro (£1)	20/—	15/7½	20/—	Dec. 1926	3½ p.c.*
N'Changa Copper Mining	17/6	16/7½	17/6		
Oroville Dredging (£1)	5/—	4/6	5/—	Dec. 1923	3½ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May 1925	2½ p.c.
Rhodesian Congo Border (£1)	80/—	72/—	75/—		
St. John del Rey (£1)	10/4½	9/9	10/3	June 1925	6½ p.c.
San Francisco Mines (10s)	29/10½	28/10½	29/9	Jan. 1927	25s.
Santa Gertrudis (£1)	14/10½	14/—	14/9	Jan. 1927	3½ p.c.
Selukwe (2s. 6d.)	10/4½	9/—	10/—	April 1917	6½ p.c.
S. Amer. Copper (2s.)	3/4½	2/10½	3/3	Nov. 1917	75 p.c.
Tanganyika (£1)	55/7½	46/6	48/1½	Aug. 1926	7½ p.c.
Tomboy (£1)	3/3	3/—	3/3	July 1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.500	8.450	9.250	July 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation